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Book of Abstracts

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Paper ID: 19

Design of SRGAN using RRDB on Generative Model and PatchGAN on Discriminative Model

Raju Poudel [a], *Bishnu Hari Paudel* [b]

Abstract:

Super-Resolution Generative Adversarial Networks (SRGANs) have come up as a promising solution to improve the resolution of low-resolution images while preserving important details. This thesis explores designing and implementing an advanced SRGAN architecture employing Residual-in-Residual Dense Blocks (RRDB) in the generator part and PatchGAN in the discriminator part. The objective is to upscale input images of size 64x64x3 to high-resolution counterparts of size 256x256x3. The RRDBs capture intricate features and long-range dependencies within the image, facilitating the generation of high-quality pictures. Additionally, the PatchGAN discriminator aids in effectively distinguishing between real and generated images at the patch level, promoting finer-grained adversarial learning. A combined loss function comprising content loss (VGG loss) and adversarial loss is applied to achieve this. The proposed SRGAN architecture undergoes comprehensive experimentation and evaluation against existing methods, focusing on perceptual quality metrics, such as Peak Signal-to-Noise Ratio (PSNR) and Structural Similarity Index (SSIM), as well as subjective assessment by human evaluators. Results demonstrate the effectiveness of the proposed approach in generating visually pleasing high-quality images from low-quality inputs, thereby contributing to advancements in image super-resolution techniques.

Keywords:

Super Resolution, Residual in Residual Dense Block, PatchGAN, VGG Loss, Adverserial Loss

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Paper ID: 27

Topic-Wide Keyword Generation From Nepali Documents Through Graph-Based Extraction and LDA Topic Models

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Abstract:

Keywords generally represent a document's key information that provide an insight into what the document is about. Most traditional keyword extraction methods often assume a document include discussions about a single topic when generating keywords. Consideration of the role of the generated keywords in representing all the unidentified latent topics in a document is severely lacking. Hence, a hybrid unsupervised keyword extraction technique is presented that leverages graph-based extraction to evaluate the topic-wide keywords for each document by feeding the candidate word list generated from it to the LDA topic modeler. La-BSE is used to embed syntactic and semantic information of all the words and sentences in a Nepali document and the similarities among all words and sentences are evaluated. Three graphs (sentence-to-sentence, word-to-word, and sentence-to-word) are generated to incorporate the relationships between the respective entities using the similarities. A list of candidate keywords and their respective importance are obtained by using an iterative algorithm, at which traditional extraction techniques often end. LDA is used for topic modeling to identify the groups of words with high probability to fall within each topic by aggregating the extracted candidate keywords and their importance values from graph-based extraction. Since one word can appear in multiple topics, the topic-wide keywords are selected based on which words appear in the greatest number of topics. The results are compared with the human-generated keyword lists and evaluated against existing baselines. The performance evaluation shows considerable improvement from just using the graph-based extraction technique or other existing literature like applying K-means after graph-based extraction to allow representation of low-ranked words as well. The architecture can be applied in topic recommendation by analyzing the sets of keywords obtained from a huge corpus to write about the popular topic identified from human inference.

Keywords:

Keyword Extraction, Graph-Based Extraction, LDA, Topic-Wide Keywords, Sentence Embeddings

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Paper ID: 33

A Hybrid Deep Learning Model for Musculoskeletal Abnormality Detection

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Abstract:

In the field of medicine, Deep Convolutional Neural Networks (DCNNs) have made significant strides, yet they face limitations in capturing comprehensive structural information due to their restricted perception capabilities. To overcome this challenge, a novel approach is proposed which combines the strengths of VGG-16 for local detail extraction and ViT for handling global features within images.This research explores the integration of VGG-16 and ViT models to classify radiograph images based on detected anomalies. The MURA dataset, a widely recognized repository of radiographic images, comprising 40,005 images, is utilized for this classification task.

Keywords:

DCNNs, VGG-16, ViT, MURA

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Paper ID: 61

Deep Learning for Waste Management: Leveraging YOLO for Accurate Waste Classification

Shiva Shrestha [a], Samman Shrestha [b], Prateek Paudel [c], Sudarshan Gurung [d], Smita Adhikari [e], Sulav Gaire [f]

Abstract:

This study presents a novel deep learning-based waste classification system using the state-of-the-art object detection framework You Only Look Once v8 (YOLOv8) to address urgent environmental concerns. Waste categorization is essential to efficient waste management because it allows different waste kinds to be separated for proper disposal, recycling, or composting. Our method uses YOLO v8's capabilities to identify and group waste materials into four classes: bio-degradable, paper, plastic, and metal. Utilizing the improved accuracy and real-time processing of YOLO v8, our system offers a workable automated garbage sorting solution. Convolutional neural networks (CNNs) are used to build the YOLO technique, which allows for real-time object recognition and classification. The model demonstrated high precision (0.94118) and recall (0.96622), indicating that waste items were thoroughly detected. It did well in recognizing items with moderate overlap (mAP@50 = 0.98252).Furthermore, when tested with images with various factors such as angle, position, lighting, and resolution, the results show that the model can classify objects with even higher accuracy.

Keywords:

Deep Learning, Object detection, Waste classification, Waste sorting, YOLO

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Paper ID: 85

Classifying Music Genres Using Machine Learning and Deep Learning with Explainable AI(XAI)

Bikram Karki [a], Bikash Hujdar Chaudhary [b], Anil Kumar Jaiswal[c], Jenny Dev [d], Pukar Karki [e], Pravin Sangroula [f]

Abstract:

Music classification is an important task having several applications ranging from recommendation systems to content organization in digital libraries. This work explores various ML algorithms along with Explainable AI (XAI) model for the classification of musical genres using deep learning techniques. Classifiers like MLP, SVM, Naive Bayes, Random Forest, kNN, Logistic Regression, CART as well as advanced deep learning algorithms like complex convolutional neural network were used to built ML models to accurately classify songs within specific genres on GTZAN datasets. Among all classifier, XGBoost performed well with accuracy of 78.5%. Also, a deep learning model employing VGG16 architecture was used. The inclusion of LINE and SHAP showcased the factors that influenced the classification process. This model works on spectrogram image to classify music genres by finding out the pattern. This work contributes to a broader understanding of XAI applications in music classification using LIME, SHAP .

Keywords:

Music Genre Classfication, Machine Learning, Convolutional Neural Network, LIME, SHAP, XAI

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Paper ID: 86

Mode-Based Real Time Music Generation Using LSTM and GAN

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Abstract:

Composing music in a specific mode presents a daunting challenge due to the vast number of potential pitch and chord permutations, making it a tedious and time-consuming process. In this paper, we propose an advanced music generation system that addresses this issue by leveraging mode classification and separate training for accurate sequence prediction, ensuring compliance with music theory principles. Mode classification is achieved using the Hamming distance, a robust dissimilarity metric that enables precise identification of the underlying mode within a given dataset. By employing the concept of generative network whose core has been powered by Long Short-Term Memory (LSTM) models, we generate sequences of new pitch combinations and chord progressions. Incorporating a discriminative network in the system enhances the authenticity and quality of the generated compositions. The successful development of this system represents a significant contribution to the field of music generation, with the potential for further enhancements through the incorporation of advanced music theory concepts and rigorous validation techniques.

Keywords:

Discriminator, Generator, Hamming distance, LSTM, MIDI, Modes, Pitch

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Paper ID: 20

Analysis of Arc Flash and Mitigation Techniques in Substation Protection of Attariya Substation Nepal

In Bahadur Rai [a], Akhileshwar Mishra [b], Jeetendra Chaudhary [c]

Abstract:

Arc flash is a type of electrical explosion that can occur when there is a sudden and high current flow either between a conductor and ground or between two conductors. Arcing flash produces intense heat and light, and can release large amounts of energy. Arc flash analysis is required to quantify the associated risk and minimize the possible consequences with optimal protective measures. The electrical power system in Nepal is in growing phase. There are number of substations being upgraded, new substation being constructed. However, the consideration of arc flash analysis in substation protection system are not found to the level it required. The arc flash analysis is one of the important consideration for protection and control design of substation. The principal objective of this study is to quantify potential risks associated with arc flash events in the Attariya Substation and devise effective mitigation techniques. The Attariya substation is located in Far western province, Kailali District, Nepal. There were unofficial record of number of incidents related to arc flash in Attariya substation such as fire in low voltage (LV) switchgear and arcing due to underground (UG) cable termination explosion. The transformers in Attariya substation has been upgraded with higher capacity, which might have resulted in higher fault level in the substation. Thus, this study presents result of comprehensive analysis of arc flash and mitigation technique in Attariya substation. The substation's electrical power system model is created and assessed through the utilization of ETAP 19.01 software, known as the Electrical Transients Analyzer Program. There are two 16.6 MVA 33/11 kV transformers each of them connected to respective incomer and a normally open 11 kV bus tie circuit breaker. While analyzing the substation with existing protection devices (PD) and circuit breaker (CB) setting the fault clearing time and incident energy are observed to be at higher level than the proposed alternative setting of protective devices and circuit breakers. With alternative setting of protective devices the possible risk from arc flash incidents have been minimized significantly and minimize possible risk of equipment damage and injury to operating personnel.

Keywords:

Time-current curve (TCC), Arc flash, Fault Clearing Time (FCT), Arc Flash Boundary (AFB), Incident Energy

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Paper ID: 25

Reliability Assessment of Power Distribution System of Industrial Estate: A Case Study in Balaju Industrial Estate

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Abstract:

The main task of distribution system is to provide acceptable reliability, economic and quality service of electricity according to the demanded load value. To fulfill this task more accurately, the reliability assessment of the distribution system can be performed and measured using a wide variety of reliability indices. This study evaluates the reliability indices of industrial distribution network, Balaju Industrial District, and deals with the reliability of four different network configurations (Case 0-1-2-3) to increase reliability and achieve more realistic results. Using ETAP, distribution networks are designed, comparisons are made. Reliability changes achieved by network configuration have demonstrated the importance of optimal configuration planning to improve the uninterrupted and sustainable energy quality of the system. In addition, cost of electricity outage, i.e. unserved energy cost, is estimated in this paper based on industrial consumer survey for the financial analysis from the reliability point of view. Outage cost is estimated by production loss method, backup generation method and willingness to pay method. The weighted average of production loss method and backup generation method has estimated overall cost of unserved energy of BID distribution system as Rs. 28.26 per kWh, this value has been used for ECOST calculation during reliability worth analysis. The base is taken case 0 which is the existing distribution system. Cases 1, 2 and 3 are separating of two 11kV feeders by separate VCBs, adding redundant power supply and interconnections between three 11kV feeders, i.e. creating ring main, respectively. Results have concluded that all three modifications improve the reliability of the system with financial gain. As these modifications have their own importances for the reliability enhancement from the industries point of view, this paper recommends the utility office, BIDMO, for the implementation of the modifications.

Keywords:

Distribution Power System Reliability, Reliability Indices, Industrial Consumer Surveys, Cost of Unserved Energy, System Modifications

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Paper ID: 35

Implementation of various demand response programs across the countries and its impact on the bulk power system reliability

Madhav Sapkota [a], Nava Raj Karki [b], Basanta Kumar Gautam [c]

Abstract:

In recent decades, electricity power systems have seen the introduction of several demand-side participation strategies, including distributed generation, on-site storage, and demand response. The latter, now widely recognized as essential for ensuring a reliable power system, involves shifting loads to different time intervals to alleviate power scarcity during peak times, thereby aligning with fluctuating electricity prices. This study explores various demand response programs globally, tracing its origins back to the late 1980s, and ongoing research reflects a collective examination of its effectiveness and challenges in power market implementation. The paper aims to investigate demand response practices worldwide, develop a comprehensive model, and analyze its diverse effects on electric power networks. Additionally, it integrates the demand response model into a widely used power system network for research purposes. Throughout, peak demand is highlighted as critical, with a focus on evaluating power system reliability indices within a reduced peak network. The findings suggest improved system reliability, advocating tailored demand-side management approaches such as Incentive Based Demand Response (IBDR) for industrial applications and Price-Based Demand Response (PBDR) for domestic consumers, emphasizing the importance of consumer-specific solutions.

Keywords:

Demand response, System reliability,Peak network,IBDR,PBDR

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Paper ID: 40

A Current-Controller for integration Hybrid Microgrid in Existing system

Supriya Pandeya[a], Menuka Karki [b]

Abstract:

The growing demand for clean energy has led to the emergence of hybrid microgrids, integrating both AC and DC systems. Managing disturbances and uncertainties while enhancing performance remains a challenge. This study proposes a control strategy for hybrid microgrids, including single-phase controller design and simulation. A simplified dq controller is introduced to improve dynamic response without increasing complexity. Additionally, a three-phase grid-connected inverter (3-φ GCI) is simulated to meet IEEE requirements for total harmonic distortion (THD). The control scheme utilizes unipolar switching in the dq axis theory with sinusoidal pulse width modulation (SPWM) for independent control of active and reactive grid currents. The project employs MATLAB to simulate and develop the hybrid microgrid system, integrating photovoltaic panels, battery storage, wind generation, and utility grid integration. A comprehensive controller supports both single-phase and three-phase systems, enabling analysis of grid interactions, renewable energy generation, and controller performance metrics. The study advances understanding of hybrid microgrid dynamics and supports the development of sustainable energy systems.

Keywords:

phase lock loop; d-q ; synchronous reference frame; MATLAB; LCL filter; PWM generator

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Paper ID: 43

Analysis of Effects of Loading Conditions on Condition Monitoring of Induction Machines

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Abstract:

Induction machines are used in a different range of applications because of their low cost, robustness, and high efficiency. All machines, no matter how robust they are or how well they are designed, are prone to faults during their operation. Broken rotor bar faults is one of such faults and can cause a number of unwanted effects in induction motors. Condition monitoring is required to detect those faults in its inception stage to minimize the down time, economic losses and safety risks. The broken rotor fault produces the sidebands components around the fundamental frequency. By analysing the frequency spectrum of the motor input current for the sidebands, the broken rotor fault can be detected. In this paper, Discrete Fourier Transform is used to analyze the input current of the squirrel cage induction motor to study the effects of the variation of the changing load level on the sidebands to differentiate between healthy and faulty motor states.

Keywords:

Induction Motor, Condition Monitoring, Fourier Transform, Broken Rotor Bars

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Paper ID: 60

Reliability Enhancement of Electric Distribution Network Using Optimal Placement of Distributed Generation: A Case Study of 33/11KV Udipur Distribution Substation Feeders, Lamjung

Bibas Raj Acharya [a], Nava Raj Karki [b], Shahabuddin Khan [c]

Abstract:

Reliability can be considered as the capability of system to survive. Currently, consumers are demanding reliable and cheaper power supply with reduced interruption duration. It's widely acknowledged that nearly 90% of electricity interruptions generates from faults within the electric distribution system. Integration of Distributed Generations (DG) into distribution network can significantly enhance its reliability in several ways such as redundancy, reduced transmission losses, voltage support, load sharing, resilience to disasters, peak shaving, islanded operation, flexibility and modularity. Artificial Neural Network (ANN) is used to obtain the optimal location of DG based on the minimum values of reliability indices SAIFI, SAIDI and EENS for which inputs are taken as average load, distance from the feeder, number of customers connected. Electrical Transient Analyzer Program (ETAP) is a software tool widely used for the design, analysis, and operation of power systems. When it comes to reliability evaluation of distribution networks, ETAP offers several advantages such as comprehensive analysis, reliability indices calculation, fault analysis and simulation, load flow analysis, optimization and planning, integration with other modules etc. Reliability was enhanced in the Udipur substation feeder following the placement of Distributed Generation (DG) as determined by Artificial Neural Networks (ANN). This improvement is evident in the system reliability indices, with a decrease in SAIFI, SAIDI by approximately 48% and 28% respectively. Furthermore, there was an improvement in terms of Cost of Reliability Indices, with a reduction in EENS by approximately 29%. The radial distribution network of the Roy Billiton Test System (RBTS) connected at bus-2 and 33/11KV Udipur Substation Outgoing feeders is used as a case study, where different types of loads such as Residential, Commercial, Industrial and Governmental & Institutional are connected.

Keywords:

Reliability, Distribution System, Distributed Generation (DG) Artificial Neural Network (ANN), SAIFI, SAIDI, EENS, ETAP

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Paper ID: 22

Nepali Question Answering System from Multilingual BERT Model and Monolingual BERT Model

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Abstract:

A question answering system typically employs methods from Natural Language Processing, machine learning, and knowledge representation to grasp the intent of questions and deliver suitable responses from a related context in a dataset or knowledge base. This paper focuses on developing a Nepali language question answering system by incorporating advanced techniques utilizing both multilingual BERT (Bidirectional Encoder Representations from Transformers) and monolingual BERT models. The research is divided into three phases: preparation of Nepali language datasets, using them to train multilingual BERT and monolingual BERT models, and finally fine-tuning with Nepali question-answer datasets. The primary goal is to explore the potential implementation of these language models in addressing question answering in the Nepali language. To facilitate this investigation, a specialized Nepali question-answering dataset is created by translating and standardizing SQuAD datasets. The study employs both multilingual BERT and monolingual BERT models to train the Nepali Question Answering System. Multilingual BERT, capable of handling multiple languages simultaneously, is utilized to tap into the broader linguistic context shared among different languages, while monolingual BERT is tailored exclusively for Nepali, providing a focused and language-specific approach to the system's development. The research emphasizes the importance of leveraging larger datasets in Nepali, as they significantly contribute to the models' training efficacy. By combining the strengths of multilingual and monolingual BERT models and fine-tuning them on a Nepali question-answering dataset, it is found that the multilingual BERT model, mBERT, performs better than monolingual BERT model, NepBERTa with F1 score of 0.75 compared to 0.66.

Keywords:

NLP, Multilingual BERT, Monolingual BERT, Nepali Question-answering

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Paper ID: 23

A Hybrid Approach for Sugarcane Leaf Disease Classification Using CNN and Gradient Boosting Algorithms

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Abstract:

Sugarcane is a globally significant crop, primarily cultivated for sugar and ethanol production. One of the prominent challenges in the sugar industry is the prevalence of sugarcane diseases, leading to substantial financial setbacks for small-scale farmers if not addressed promptly, often resulting in the removal of affected crops. The adoption of deep learning techniques has garnered increasing attention in the realm of research on crop disease classification. In this research, we present an approach to classifying sugarcane leaf diseases utilizing MobileNetV2 with an enlarged receptive field to extract features, coupled with XGBoost, CatBoost, and LightGBM as classifiers. The model is trained and assessed on a dataset comprising sugarcane leaf images categorized into five classes: healthy, mosaic, red rot, rust, and yellow leaf. The proposed MobileNetV2 outperformed baseline MobileNetV2 and other traditional models. When utilizing the proposed MobileNetV2 as the feature extractor, CatBoost acheived better results compared to XGBoost and LightGBM classifiers. The soft voting ensemble of these classifiers yielded the best overall performance.

Keywords:

CatBoost, Dilated Convolution, LightGBM, MobileNetV2, Sugarcane Leaf Disease, XGBoost

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Paper ID: 28

Enhancing NVMe Storage Performance with Latency-Aware User Layer Semantics and Dynamically Adjusted Timeouts

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Abstract:

Upon completing a request, an I/O device faces the decision of either minimizing latency by promptly issuing an interrupt or optimizing throughput by delaying the interrupt, anticipating the completion of more requests soon and thus reducing the overall interrupt cost. To achieve a balance between these conflicting objectives, devices employ adaptive interrupt coalescing heuristics. However, these heuristics rely on static timeout and threshold values, leading to suboptimal performance in non-uniform IO workloads. Furthermore, devices lack semantic information regarding the latency sensitivity of I/O requests, which can result in undesired outcomes through interrupt coalescing. This paper proposes a method to enhance I/O device performance by enabling software to specify the latency sensitivity of requests. Subsequently, the kernel can utilize this information to coalesce interrupts dynamically using adjusted timeout and threshold values. Additionally, we address the challenge of high interrupt rates and latency when all I/O requests are marked as latency-sensitive. We introduce a dynamic timeout value based on the remaining IO requests, considering the incoming IO request rate and the NVMe device's IOPS capability to optimize performance. Our approach eliminates the need for manual input of timeout and threshold values based on workload, instead utilizing an exponential-based correction factor. Experimental results demonstrate reduced CPU consumption and latency in both uniform and variable IO workloads.

Keywords:

NVMe, Performance, Coalescing, Kernel, IOPS, Interrupt

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Paper ID: 51

Sahaj Yatra: A Digital approach to transportation

Aayush Shrestha [a], Dikshyanta Aryal [b], Pramis Gurung [c], Santosh Kumar Rajbhandari [d]

Abstract:

This is a digital bus fare management system, which address the problems faced by both passengers and bus owners in fare collection. This system utilizes RFID-based scanning and the NodeMCU for hardware integration. The system aims to enhance the passengers experience and improve operational efficiency by offering seamless fare validation and convenient payment options. This project aims to provide a fair fare management system providing consumers with a easy and hassle free experience. The passengers will be issued RFID cards, which will be scanned by onboard RFID scanners installed on buses to deduct the fare amount in real-time. The Node server will handle user registration, fare deduction, recharge history, and transaction logs, all of which will be saved in a database, ensuring secure storage and efficient data management. Moreover, the passengers will be able to track the bus in real-time, helping them manage their schedule accordingly. Additionally, they will be provided with the facility to recharge their cards using local payment methods, enabling a hassle-free experience. The bus operators will be provided with the facility to get an overview of the details of buses owned by them. The proposed Digital Bus Fare Management System brings efficiency and convenience to the existing transportation system, improving the daily lives of millions of passengers and introducing a hassle-free service for both passengers and bus operators.

Keywords:

Database, GPS, Nodejs, NodeMCU, RFID, Transaction logs

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Paper ID: 52

End to End Automatic Speech Recognition in Sanskritam from Raw Waveforms and its Adaptation to Nepali using Second Pass Language Model

Siddhant Baral [a], *Hari Prasad Baral* [b]

Abstract:

Automatic Speech Recognition in the field of Low-Resource Language is an open field of Research. New methodology and domain specific adaptations are expected to challenge the problems of small data. Our model is attempting to develop a robust ASR system for Nepali language using Sanskritam. Both of these are Low Resource Languages, and use of Sanskritam instead of Nepali itself for developing an ASR in Nepali is counterintuitive. But we are relying on the tightly bound grapheme-phone features of Sanskritam. Given that Nepali has phonetic and grapheme subset of Sanskritam, this approach can be valuable. Additionally, use of Second pass text-to-text rescoring model in will help correct the deviations Nepali Language has seen in contrast to Sanskritam. This model can prove to be a single shot solution for many Indic Languages since the second pass language features can be plug and play without requiring any training in the acoustic model.

Keywords:

Sanskritam ASR, Nepali ASR, Two Pass, Raw Waveform ASR

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Landslide Susceptibility Mapping Under Climate Change Scenarios Using XGBoost Algorithm

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Abstract:

Rainfall can be considered an important landslide-triggering factor in the context of Nepal as most of the landslides occur during the monsoon season. Climate change is expected to increase the frequency and intensity of rainfall events in the future. Climate change-induced extreme hydro-meteorological conditions can increase the prevalence of landslides in a geologically fragile region like Nepal. In this study, we investigated the susceptibility of landslide events under different future Shared Socio-economic Pathways (SSP) scenarios in Lamjung district. We developed landslide susceptibility maps for the baseline period (1995-2020), and future climate scenarios were prepared with a set of three Coupled Model Intercomparison Project (CMIP6) models under SSP245 and SSP585 for near future (2021-2045), mid-future (2046-2070) and far future (2071-2095). A machine learning algorithm XGBoost was utilized for the generation of the landslide susceptibility maps. Twelve multi-variate factors contributing to landslides were considered including terrain slope, aspect, elevation, curvature, TWI, SPI, geology, soil, distance from the stream, distance from the road, land use/ land cover, and mean annual rainfall, with rainfall selected as a dynamic factor. Further, various metrics like Accuracy, Recall, Precision, Mathew's correlation coefficient, F1-Score, and Area under the Curve (AUC) were used to evaluate the quality of the model. A total of seven landslide susceptibility maps were developed and classified into five susceptible classes and compared. The baseline susceptibility maps show that 2.88% and 3.29% of the study area lie in high and very high susceptibility classes. The results of the future landslide susceptibility show an increase in the high and very high susceptibility classes for both SSP245 and 585 scenarios compared to the baseline landslide susceptibility map.

Keywords:

Landslide susceptibility, CMIP6, XGBoost, Climate change, Precipitation projection

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Paper ID: 16

Modeling Transient Rainfall Effects on Landslide Occurrence and Debris Flow: Insights from Chandragiri

Ribash Dahal [a], Ananta Man Singh Pradhan [b], Pawan Kumar Bhattarai [c]

Abstract:

In the terrains of Chandragiri, Nepal, the frequent and intense monsoonal rains pose a significant threat of landslides and subsequent debris flows. This study applies the Transient Rainfall Infiltration and Grid-Based Regional Slope-Stability Analysis (TRIGRS) alongside Flow-R, a MATLAB-based empirical model, to predict these natural hazards. TRIGRS was employed to simulate the infiltration processes and slope stability under variable rainfall conditions, establishing the initial susceptibility to landslides. Flow-R was then utilized to delineate the potential paths and extents of debris flows originating from these landslides. The models were calibrated using historical landslide data, resulting in a predictive accuracy with an AUC of 0.71 for the ROC curve. Our findings illustrate the critical interplay between rainfall patterns and slope stability and underscore the utility of integrated modeling approaches in enhancing the predictability and understanding of landslide and debris flow hazards in mountainous regions. This study provides vital insights for regional disaster preparedness and land-use planning aimed at mitigating the impacts of these geohazards.

Keywords:

TRIGRS, Flow-R, Shallow Landslide, Rainfall induced landslide, Transient rainfall

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Paper ID: 17

Geogrid Reinforced Flexible Pavement: Thickness Reduction Potential and Increment in Service Life

Kabin Lamichhane [a], Dhanapati Dhakal [b], Bijay Bhattarai [c]

Abstract:

This study performs a numerical analysis to evaluate the effectiveness of single-layer geogrid-reinforced flexible pavement, with the geogrid positioned optimally. The analysis takes into account varying California bearing ratio (CBR) values of subgrade, which range from 5% to 15%, and traffic loads that span from 5 million standard axle (MSA) to 30 million standard axle (MSA). The analysis is carried out with the aid of PLAXIS 3D, a finite element method (FEM) based software. A linear elastic model simulated pavement layers (asphalt course, combined granular base and subbase course and subgrade), and initial validation compared vertical subgrade strain for unreinforced pavement with IITPave's and DoR sheet's results. Results show that the subbase and subgrade interface is the optimum position for geogrid reinforcement. Significant thickness reduction is possible in existing unreinforced flexible pavements after geogrid insertion, with increase in service life as well. Based on the study results, a geogrid reinforced pavement design catalogue is proposed and compared with the existing Department of Roads, Nepal (DoR) flexible pavement design guidelines, 2021. The study also investigates the lifespan improvement of the reinforced pavement layer compared to the unreinforced one.

Keywords:

Flexible Pavement; Geogrid Reinforcement; Optimum Position; Thickness Reduction; Performance Enhancement

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Paper ID: 41

LEM based analysis of Guthitar landslide along Dharan-Dhankuta Highway

Puskar Raj Gautam [a], Bhim Kumar Dahal [b]

Abstract:

Dynamic slope instabilities pose significant challenges to infrastructure integrity and safety, particularly in mountainous regions. This study investigates the phenomenon of moving landslides along the Guthitar section of the Dharan-Dhankuta Highway, where persistent road settlement issues have been observed for a very long period of time. Employing Limit Equilibrium Method (LEM) analysis through SLOPE/W software, we assesed the weak slope stability contributing to these occurrences. The analysis reveals a factor of safety of about 0.9 in the slope model, indicative of such precarious conditions. The instabilities and road settlement problems observed on site have been sufficiently replicated in our soil model. The findings underscore the importance of understanding the causes and mechanisms of slope failure problems before implementing effective mitigation strategies to safeguard critical infrastructure and mitigate hazards in landslide-prone regions.

Keywords:

LEM, GeoStudio, Slope Stability

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Paper ID: 54

Influence of Organic Matter on Engineering Properties and Shear Properties of Soil: A case study of Kathmandu Clay

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Abstract:

This study offers a synopsis of the effects of natural organic content in clay on engineering properties, particularly in shallow foundation. As the past studies it shows that the organic matter in the clay plays a vital role in soil engineering properties. The engineering properties of the soil is related with the organic matter in the soil. The relation between natural organic content to its engineering properties is discussed. Additionally, it highlights the varying percentages of organic matter in natural condition in clay through laboratory tests and their consequences.

Keywords:

Angle of friction; Cohesion; Natural organic content

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Analysis of Climate Induced Landslide Susceptibility Map using Machine Learning Algorithm: A case study of Nuwakot District, Nepal

Prem Raj Bhattarai [a], *Bhim Kumar Dahal* [b]

Abstract:

This paper investigates the climate change influence on landslide susceptibility mapping (LSM) in Nuwakot district, under the future climate change scenarios. The study employs 11 factors as a landslide contributing factor, such as terrain slope, aspect, curvature, elevation, geology, TWI, SPI, distance to stream, distance to road, land use/ land cover, and rainfall. Among them, rainfall is considered a dynamic climate factor. In this study, the machine learning algorithm called XGBoost was selected in order to map landslide susceptibility within the context of baseline (1995-2019) and for the future: near future (2021-2045), mid future (2046-2070) and far future (2071-2095) under SSP245 and SSP585 scenarios, which are based on the three Coupled Model Inter-comparison Project Phase 6 (CMIP6) global climate model ensembles. Data preparation and normalization are performed using QGIS. Based on the results, future annual rainfall is expected to rise under both scenarios, with SSP585 exhibiting more significant climatic changes. The AUC value of 97.25% indicates that XGBoost is an effective classifier for LSM in the study area, and evaluation metrics such as accuracy, recall, precision, Mathew's correlation coefficient, and Kappa Coefficient are used to measure the quality of the model. Altogether, seven LSMs were generated, including baseline and future scenarios, in which future scenarios have an increase in high and very high-class values compared to baseline susceptibility map. Thus, the result indicates that the far future LSM under the SSP585 zonation is impacted more significantly due to the effect of climate change.

Keywords:

Landslide Susceptibility, Climate Change, CMIP6, XGBoost, Extreme Rainfall

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Paper ID: 34

Automatic Number Plate Detection and Recognition Using YOLOv8 and CNN

Kshitiz Gajurel [a], Manoj Kumar Baniya [b], Khushilal Mahato [c], Manish Kathet [d], Suwarna Lingden[e], Pukar Karki[f]

Abstract:

This paper introduces a tailored Automatic Number Plate Detection and Recognition (ANPDR) framework designed specifically for the unique challenges of the Nepali context. The framework leverages the YOLOv8 model for efficient plate detection, coupled with Byte-sort Tracking for precise detection and tracking of vehicles and plates within video frames. A preprocessing stage further enhances the system's adaptability by isolating characters from plates, effectively addressing variations in environmental conditions. In character recognition, a pivotal aspect of ANPDR, Convolutional Neural Networks (CNNs) are employed, with a particular emphasis on recognizing Devanagari characters commonly found on Nepali number plates. The CNN model, trained on a customized dataset, ensures accurate recognition even under challenging conditions. Additionally, post-processing techniques are implemented to bolster the system's robustness and reliability. The results of this study showcase the comprehensive ANPDR solution's effectiveness. The YOLOv8 model achieves high accuracy in plate detection, with precision of 91% demonstrating its robust performance. Similarly, the CNN-based character recognition model achieves outstanding results, with an accuracy of 90%, highlighting its efficacy in accurately identifying individual characters on detected number plates. The framework demonstrates significant potential for deployment in various applications, including traffic management and law enforcement, thereby contributing to the development of safer transportation infrastructures in Nepal. Moreover, the dataset utilized in this study encompasses a diverse range of images, representing numerous classes, facilitating robust training and validation procedures. These results underscore the practical applicability and effectiveness of the proposed framework in real-world scenarios, addressing a pressing scientific problem and offering tangible contributions to the field of ANPDR technology tailored for the Nepali context.

Keywords:

YOLOv8, Byte-sort tracking, character segmentation, CNN, ANPDR

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Paper ID: 42

Mechanical Automation with Vision: A Design for Rubik's Cube Solver

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Abstract:

The core mechanical system is built around three stepper motors for physical manipulation, a microcontroller for hardware control, a camera and YOLO detection model for real-time cube state detection. A significant software component is the development of a user-friendly graphical user interface (GUI) designed in Unity. The initial state after detection from real-time YOLOv8 model (Precision 0.98443, Recall 0.98419, Box Loss 0.42051, Class Loss 0.2611) is virtualized on GUI. To get the solution, the system employs the Kociemba's algorithm while physical manipulation with a single degree of freedom is done by combination of stepper motors' interaction with the cube achieving the average solving time of ∼2.2 minutes.

Keywords:

Kociemba, Mechanical system, Rubik's Cube, Stepper Motors, YOLO

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Quantum-Classical Hybrid Approach For COVID-19 Severity Classification From Chest CT Images

Prabhakar Singh [a], *Shashidhar Ram Joshi* [b]

Abstract:

COVID-19 has significant worldwide effects in the areas of social, medical, and economy.Because of the severe effects of a disease that causes lung damage and increases susceptibility to lung infections in the population, the World Health Organization declared a Public Health Emergency of International Concern.In order to prioritize life-saving care, it is imperative to identify and evaluate the severity of COVID-19 infection in relation to other respiratory illnesses. Specialists may deploy resources more effectively and help patients in emergencies sooner when they do effective evaluations.In expert-evaluated COVID-19 CT lung images, ground glass opacity is frequently observed. Innovative methods for medical image analysis might be made possible by quantum computing's promise to explore quantum machine learning (QML). In this study,the features are extracted by using quantum, with the abundance of data, machine learning benefits from enhanced speed and computational complexity to handle larger weight matrices for improving performance.Exploring quantum techniques for severity classification in machine learning using a Quantum-Classical hybrid model on varied input image sizes (28×28, 32×32, 64×64) running on a simulator. The patient's CT images are classified by the Quantum-Classical model into three severity classes: Critical, Severe, and Moderate. The paper demonstrates that a hybrid model outperforms CNN, achieving 96.82% accuracy with smaller 32x32 images and 3075 trainable parameters compared to VGG-19, which achieves 85.97% accuracy with larger 64x64 images and 262,659 trainable parameters.

Keywords:

COVID-19,Severity,Chest CT images, Accuracy,ROC,Quantum-Classical

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Paper ID: 63

Nepali Sign Language Letter Detection and Finger Spelling Using Mediapipe and CNN

Guptaraj Shrestha [a], Nishan Thing [b], Prajita Dhakal [c], Prasanga Dahal [d], Pukar Karki [e], Manoj Kumar Guragai [f]

Abstract:

This paper describes the development of a machine learning model to translate Nepali SiFgn Language (NSL) gestures into corresponding Nepali text format. The system utilizes computer vision and deep learning techniques, specifically a Convolutional Neural Network (CNN) model trained on a dataset of over 2,500 images per label with total of 50 labels. The training accuracy was 99% where as the validation accuracy was 87.78%. Training loss setteled to 1.18% and validation loss was settled to 8.258%. Drop out layer and early stopping function were introduced and model was trained for 50 epochs and finally. The model achieved training accuracy of 99.84% and validation accuracy of 99.80%. Similarly, model Training Loss was 0.6% and Validation Loss was 1.16%. The Accuracy curve showed that the both validation and training accuracy gradually increased to 90% for 10 epochs and became steady. Similarly,in Loss curve both validation and training loss gradually decreased to 4% over the course of 10 epochs and stabilized. A Classification table was created using 20% of total dataset with 500 for each label. Model performance was exceptional for most of the labels achieving precision, recall and F1-score close to 1. However,for some labels ,model performance was lower in terms of precision (less than 0.98). The overall accuracy of model was 0.99 describing that model perform well on the entire dataset. The trained model was integrated into a user-friendly web application along with the logic for finger spelling to verify and validate the real life use case of the research.

Keywords:

Nepali Sign Language, Machine Learning, Convolutional Neural Network, MediaPipe

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Paper ID: 64

An Integrated Approach for Wildlife Recognition in Nepal Using Video Along With Audio

Zishan Siddique [a], Sandip Pariyar [b], Venus Bastola[c], Sushant Phagu [d], Binay Lal Shrestha [e], Pravin Sangroula [f]

Abstract:

Wildlife around the world is in decline primarily due to the loss of habitat as well as the intersection of territory between humans and wild animals. Manual recognition of animals can be more accurate but will require exponentially greater resources both in terms of capital and labor making it unfeasible in large-scale deployment, especially for a country like Nepal. We have developed a system for the recognition and classification of wild animals using deep convolutional neural network (DCNN) architecture to aid conservation as well as a study of our ecological system. We used iNaturalist as our source for image data and Xeno-canto.org as the source for audio data. We were able to achieve an F1-Score of 86.12% on image data of 44 species of animals and an F1-Score of 88.1% on audio data of 23 species of birds all found in Nepal.

Keywords:

Convolutional Neural Network, EfficientNet, Audio, Video

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Paper ID: 78

Automatic Identification of Monuments in Images using Single-Shot Detectors

Prajesh Shrestha [a], Ujjwal Paudel [b], Santosh Pandey [c], Rishav Subedi [d], Dinesh Baniya Kshatri [e]

Abstract:

Monuments, embodying historical, archaeological, and cultural significance, serve as gateways to unraveling rich histories, particularly for foreigners. To aid monument identification within images, we fine-tuned the lightweight Convolutional Neural Network (CNN) model, MobileNetV2, with Single Shot MultiBox Detector (SSD) for feature extraction and prediction of monument locations and labels. Subsequently, we trained a small variant of the more resource-intensive You Only Look Once (YOLOv5s) model. Our dataset comprised manually collected databases from Kathmandu Valley's three Durbar Squares: Kathmandu, Bhaktapur, and Patan. The SSD reached a maximum mAP@0.5 score of 78.68% for test data, while the YOLOv5s model demonstrated superior performance, with mAP@0.5 scores peaking at 92.77%.

Keywords:

CNN, Fine Tuning, MobileNetV2, Monument Detection, SSD, Transfer Learning, YOLOv5s

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Stakeholder Analysis in Housing Partnership: Case of Nepal

Nistha Nakarmi [a], Sangeeta Singh [b], Sudhil Bahadur Bajracharya[c],

Abstract:

Nepal is under pressure to provide access to basic infrastructure and planned urban development (MOUD,2017).AS 66.2% of its population currently lives in urban areas (CBS,2021). The vision for 2030 for urban development strategy calls for 15% of the total housing requirement to come from organized housing (Both private and public sector) and 50% of new residential area to be developed through land readjustment process. It also specifically mentions the private/ cooperative sector to provide housing for the poor in large towns. The plan for this includes promoting the private sector through initiative like reviewing and creating a suitable incentive and facility package such as land or infrastructure, to offer homes for stratum who are economically weaker (MOUD, 2017). The vision is indicative of incorporating public private partnership (PPP), however, detailed strategies and activities to achieve it is not clear. The paper thus, focuses on the stakeholder's analysis in the partnership as preliminary key components for housing partnership. The study is explorative type with mixed method consisting of literature review and sectoral case study. The findings of the study are represented in power and interest matrix of the stakeholders where the contextually relevant stakeholder mapping has been traced categorically through the lens of power and interest dynamics. The study recommends on the need of proper stakeholder analysis as a fundamental to establish partnership framework.

Keywords:

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Paper ID: 45

Risk Assessment in Selected Hydropower Projects of Nepal under Engineering, Procurement and Construction (EPC) Contracts

Tika Ram Niroula [a], Manu Kumar Poudel [b], Gyenendra Prasad Kayastha [c]

Abstract:

Risk management is a systematic process that includes risk assessment analyzing and responding to the risks. This research primarily focus on the risk assessment and also studies the possible risk management measures through risk allocation and other measures. To achieve the objective of this research, the list of risks has been identified from the review of various literatures and were asked with the experts of relevant fields to find the applicability in the context of Nepal. Furthermore, the identified risks were finalized and grouped into nine groups. The questionnaires were targeted to the professionals from employer, contractor and consultant of selected hydropower projects. The set of questionnaires were sent to 74 number of respondents from of 4 projects and 62 responses were achieved and only 60 were found to be valid. For ranking of the risks as per their significance, the RII has been used. The significance of possible risk management measures were have been evaluated from questionnaire survey using the relative importance index technique. As a part of risk management measure, the KII is done to find the risk allocation to employer, contractor, shared risks and transferred risks. The relative importance index of each risks along group and overall RII is calculated and ranked to find the correlation between the different ways and the testing of hypothesis has been done to find out the significance of correlation. The major 46 risks grouped into 9 groups are identified and those risks were used for further study of their significance. The total risk score is calculated as the product of probability and impact. The most significant risks identified were "risk of subsurface geology", "force majeure" and "construction delays". From the study it was found that the major risks has been shared by the parties and one has been transferred to other party as risk management measures. The other most significant risk management measures identified were "preparation of contract documents by highly experienced personnel", competent project management team and conduct sufficient investigations and feasibility before procurement. This study has recommended to work out on the detailed risk management of projects before project formulation and minimizing the unforeseeable risks and those should be taken by the employer. From the study it was found that the major risks has been shared by the parties and one has been transferred to other party as risk management measures. The other most significant risk management measures identified were "preparation of contract documents by highly experienced personnel", competent project management team and conduct sufficient investigations and feasibility before procurement. This study has recommended to work out on the detailed risk management of projects before project formulation and minimizing the unforeseeable risks and those should be taken by the employer.

Keywords:

Risk Assessment, Risk Management, Hydropower, Engineering, Procurement and Construction (EPC) Contracts

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Paper ID: 56

Solar PV Lift Irrigation for Agriculture in Narainapur Rural Municipality, Banke

Prajwol Lamichhane [a], Ajay Kumar Jha [b], Prashant Kumar [c]

Abstract:

Climate change is a pressing global issue and its impact is already seen on various sectors like water sources, agriculture, biodiversity and livelihood. The agricultural sector, in particular, faces substantial challenges which can potentially trigger global food crisis in future. In 2022, Narainapur Rural Municipality (NRM), previously a major contributor to agricultural production of Banke district of Nepal, was declared drought hit area due to lack of proper rainfall. Therefore, this study aims to investigate the feasibility of solar powered lift irrigation to improve the agriculture productivity and livelihood in NRM. To determine the peak photovoltaic power required to irrigate a hectare of land in NRM, time series analysis was done on climatic datas from 1996 to 2023 for forecasting future trends upto 2040. Using FAO's Cropwat 8.0, the irrigation water requirement (IWR) for two major crops (rice and wheat) was calculated., identifying the maximum IWR of about 133.84 m3/day/hec in April in the year 2023. Similarly, ground water levels were analyzed from 2001 to 2023 for 18 wells located around the Banke District and ground water maps were prepared in Esri's ArcGIS 10.3 using Universal Kriging Method with the highest level of 9.87m found in the month of April. Based on these datas, the peak photovoltaic power required to operate a conventional pump was calculated to be 3.24 kWp. Then, system sizing was done to select economical solar irrigation components. A life cycle cost analysis was performed comparing the solar PV irrigation system with existing diesel based irrigation system. It was found that solar pv irrigation system was more economical and cost effective than the diesel based irrigation system. Thus, the study highlights the potential of solar-powered lift irrigation as a sustainable solution to address agricultural challenges in Narainapur rural municipality and similar regions.

Keywords:

Irrigation water requirement (IWR), Ground water interpolation, Peak solar PV power, System sizing, Life cycle cost analysis

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Paper ID: 58

Irrigation Performance of Western Canal, Kamala Irrigation Project Using Remote Sensing and GIS

Shovakant Raut [a], Saroj Karki [b], Pawan Kumar Bhattarai [c]

Abstract:

This study focuses on evaluating the performance of the Western Canal command area of the Kamala Irrigation Project(KIP) in Nepal using remote sensing (RS) and Geographic Information System (GIS) techniques. This study addresses a critical need for efficient and equitable water management in Nepal's agriculture sector, where irrigation systems are vital for sustaining livelihoods and economic growth. By use of remote sensing and GIS technologies, the research aims to enhance the understanding of irrigation performance and facilitate informed decision-making for sustainable agricultural practices. The study area covers 12,500 hectares (ha) and is characterized by a main canal, branch canals, minor distributaries, and water user associations. The research utilizes satellite imagery from Sentinel-2 to estimate crop areas and yields, particularly focusing on winter crop cultivation. The Normalized Difference Vegetation Index (NDVI) is used to assess crop health and productivity. Performance indicators such as Relative Water Supply (RWS), Equity and Water Use Efficiency (WUE) are computed to evaluate the efficiency and fairness of water distribution in the irrigation system. Results indicate that the irrigation system tends to over-irrigate, with an RWS of 7.06 during the winter season of 2020-2021. The study also reveals disparities in cropped area and crop health between the head and tail ends of the canal, highlighting the need for equitable water distribution. The WUE for the study period is it produced a lower output per unit of water i.e 0.176 kg/m^3 indicating the system's efficiency is not satisfactory.

Keywords:

GIS,Irrigation performance,Remote sensing,Water productivity

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Paper ID: 75

Environmental Performance Assessment: Life Cycle Assessment for Energy and Emissions of Reinforced Cement Stabilized Rammed Earth Residential Buildings in Nepal

Shrijan Basnet [a], *Sushil Bahadur Bajracharya* [b]

Abstract:

Residential buildings primarily consume energy during their construction. In such structures, the operational energy is relatively low compared to the embodied energy. The objective of this study is to enhance understanding of energy and emissions in reinforced cement stabilized rammed earth (CSRE) residential buildings. The research evaluates the life cycle energy and emissions of the building from cradle to gate, in accordance with the guidelines established by ISO 14040 and ISO 14044 standards. The study presents the construction process, the materials utilized, and offers suggestions for future improvements to the structure's environmental performance. The research applies IFC 2017, ICE 2011, and IPCC 2018 standard data to determine the embodied energy. The environmental impacts are assessed based on ozone depletion potential (ODP), eutrophication potential (EP), acidification potential (AP), and photochemical ozone creation potential (POCP). The life cycle energy from cradle to gate of the studied Reinforced Cement Stabilized Rammed Earth (CSRE) Walls is 0.57 MJ/kg, and the life cycle energy from cradle to gate of the studied building is 3.5 GJ/m^2. Similarly, the life cycle carbon emission from cradle to gate for the walls is 0.059 kg/kg CO^2 eq., and that of the overall building is 0.33 T/m^2. The high thermal mass of the rammed earth wall minimizes the fluctuation of indoor air temperature compared to the outdoor temperature and maintains almost constant indoor humidity. The environmental performance of the structure in terms of energy and emissions is better than that of a that of a brick-masonry structure. Replacing reinforced CSRE walls with 10-inch brick masonry walls (in cement mortar 1:4) would increase the life cycle energy by 43.6%. and emission by 41%. The environmental performance of the structure can be improved by substituting the aluminum frame used in the doors and windows with a wooden frame. Replacing aluminum with wood used in doors and window frames can reduce life-cycle energy by 5.5% and carbon emissions by 16.8%. Based on the environmental performance of the structure, Reinforced CSRE is a suitable choice for the construction of residential buildings.

Keywords:

Life Cycle Assessment, Rammed Earth, Energy, Emission, Impact Assessment,Sustainability

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Paper ID: 80

Seismic Vulnerability Assessment of Historic Masonry Structure: A Case Study of Bindhyabasini Temple

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Abstract:

The seismic vulnerability assessment of Bindhyabasini Temple, a 250-year-old stone unreinforced masonry structure in Nepal, is presented in this paper. The study encompasses both qualitative and quantitative evaluations. Qualitative assessments involved rapid visual screening and empirical vulnerability index methods, supported by field visits and interviews with locals and the temple committee. Quantitative assessments entailed computer software-based building design and seismic behaviour evaluation through time history analysis. Following both evaluations, a vulnerability curve and a checklist were formulated. The vulnerability curve showed the expected damage at different intensities which may be slight, moderate, and extensive damage grade. The structure is vulnerable to both tension and shear in the openings and dome-wall connection. This research serves as a valuable resource for assessing seismic vulnerability in similar building typologies.

Keywords:

Non-destructive Test, Rapid Visual Screening, Stone Masonry, Time History Analysis, Vulnerability Curve, Vulnerability Index

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Paper ID: 31

Design, Fabrication and Testing of Electric Pottery Wheel

Aaryan Gautam [a], Amit Gyawali [b], Basant Belbase [c], Bikram Gautam [d], Chiranjivi Dahal [e], Uttam Dhakal[f]

Abstract:

The focus of this work is to discuss the design and building of an electric pottery wheel in order to solve the challenges of manual pottery wheels and increase the efficiency, accessibility, and quality of pottery manufacture. The objective is to develop an electric pottery wheel that is reliable, easy to use, and safe, with constant rotational speed and torque. By managing the spinning process, the electric pottery wheel will make pottery making more accessible to a larger number of people, including those with limitations in their bodies. It will also enable potters to create complicated patterns and fine details with perfect precision. To create an efficient and flexible wheel, select high-quality components, conduct thorough evaluations, and use relevant safety measures, collaboration among ceramic artists, engineers, and designers is required. This report emphasizes the importance of inclusivity, productivity, and artistic potential in the pottery community, as well as a budget breakdown and timeline for the fabrication process. The fabrication of an electric pottery wheel has the potential to revolutionize the pottery-making process and empower a diverse group of individuals to get involved in this ancient craft.

Keywords:

electric, fabrication, potential, pottery manufacture, pottery wheel, budget, empower

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Development and Testing of Non-Contact and Wireless Tachometer

Sajan Bhujel [a], Prahar Basnet [b], Tirtha Bahadur Khadka [c], Tulsi Ram Bhandari [d], Vikash Verma [e], Chiranjivi Dahal [f]

Abstract:

This paper mainly emphasis on developing a contactless and wireless digital tachometer for measuring the rotational speed in Revolution per Minute (RPM). The tachometer is constructed through the integration of a microcontroller, an infrared system, and a Bluetooth Module in which the infrared system senses the interruption in the beam of rays caused by rotating object and generates pulses which will be sent to the microcontroller. These pulses will be counted and displayed on the Bluetooth Serial Monitor Application via Bluetooth Module in RPM on every one second. Through comprehensive testing at various speeds, including 498 RPM, 995 RPM, 1992 RPM, 2989 RPM, 3992 RPM, 4996 RPM, 5993 RPM, and 6995 RPM, the highest accuracy was achieved at higher RPM, displaying the percentage error less than 0.3% and the lowest accuracy was at lower RPM, with an maximum percentage error of 15.4%. These findings underscore the precision and reliability of the tachometer at different speeds which provides valuable insights for its practical application.

Keywords:

Pulse Width Modulation, Infrared, Microcontroller, Bluetooth.

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Paper ID: 70

Comparative Analysis of Passive and Semi Active Suspension System

Suraj Kumar Chaurasiya [a], Subu Khand [b], Manisha Sarki [c], Shacheendra Kishor Labh [d]

Abstract:

This paper aims to explore and analyze the performance of semi-active suspension systems using different control techniques. The suspension system plays a critical role in enhancing the overall ride comfort and stability of vehicles. By employing semi-active suspension systems, the damping characteristics can be adjusted in real-time, leading to improved vehicle dynamics. This investigation uses several control techniques such as: Fuzzy logic control, PID, and FPID controller that utilized computer simulations to evaluate the effectiveness of various control techniques for semi-active suspension systems of quarter car model. Performance of the semi-active suspension with control techniques are compared with the passive suspension system in terms of peak overshoot and settling time. Simulation result after comparison shows the improvement by 31.37%, 9.85%, and 26.05% using PID, Fuzzy and FPID controlled suspension system.

Keywords:

Fuzzy Logic Control, Passive suspension system, PID Control, Semi-active Suspension System

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Paper ID: 76

Numerical Study and Comparison of Drag Coefficient of Sphere at Various Blockage Ratios

Hardik Shrestha [a], Rajesh Kumar Shrestha [b], Ashim Thapa [c], Binita Ale [d], Prabin Karki [e], Dipesh Karki [f]

Abstract:

The drag coefficient plays a dominant role in the motion of objects in fluid. This work aims is to perform numerical analysis to obtain drag coefficient of sphere at various Reynold numbers. Furthermore, we also aim to see the effect of blockage ratio in the drag coefficient of the sphere. The geometry of the sphere is modelled in design modular and meshed in ICEM CFD to study the flow behavior around the sphere. The diameter of the sphere was set at 0.1m. The dimensions of the computational grid were changed accordingly to obtain the blockage ratio of 0.3 and 0.5. We have also visualized the pressure contour, velocity contour and flow separation. Additionally, this study compares the result obtained from Reynold Averaged Navier-Stokes (RANS) simulation with the existing literature and the subsonic wind tunnel. Additionally, the study compares simulation results with experimental data to validate the accuracy of numerical value. Overall, this analysis provides valuable insights into the flow characteristics around a sphere aiding in the design and optimization in the various engineering systems.

Keywords:

Blockage ratio, Coefficient of drag, Drag, Sphere, ANSYS

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Paper ID: 83

Influence of Etchants and factors affecting etching duration on microscopic observation of steels

Abhinab Pratap Baniya [a], Hiramani Lamichhane [b], Manish Devkota [c], Pranjal Paudel [d], Sanyog K.C [e], Durga Bastakoti [f]

Abstract:

Metallurgy explores metal properties, production, and purification. Alloys, like steels consist of multiple elements, with at least one metal. The etching approaches is important for the proper visualization of microstructure of steels under optical microscope. The research aims to enhance clarity and visibility of images under an optical microscope and to determine the duration for immersion of sample under etchant. The research utilized various etchants, including Nital etchant and Marble's reagent, to enhance the etching approaches for different types of steels. Etchants react with different phases of metals, such as pearlite, ferrite and austenite at varying rates. This reaction causes changes in the color of the phases, which in turn makes it easier to distinguish and observe them under a microscope.In conclusion, etching highlights grain boundaries and phase distribution. Optimal etching time results in a cloudy pattern on the metal surface. This paper also emphasizes on factors affecting etching duration such as heat treatment, material composition, concentration of etchants and rate of cooling alters etching time, affecting pattern formation. Notably, the immersion time in etchants for annealing samples was observed to be higher, opposing with the shorter duration for ice quenching. Efficient etching aids in microstructural analysis, crucial for understanding material properties and optimizing heat treatment processes.

Keywords:

Metallurgy, Microstructure, Etching, Heat treatment.

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Paper ID: 44

Optimal Siting and Sizing of SSSC in INPS using Modified Salp Swarm Algorithm Considering Optimal Reactive Power Dispatch Problem

Priyanka Karna [a], Jeetendra Chaudhary [b], Akhileshwor Mishra [c], Prabhat Pankaj [d]

Abstract:

Effective coordination between power generation and demand is vital for maximizing efficiency, especially with the increasing demand for electrical energy. Flexible AC Transmission System (FACTS) devices, like the Static Synchronous Series Compensator (SSSC), enhance transmission efficiency by improving power transfer capacity and stability. Integrating SSSC presents challenges due to nonlinear functions, complicating the Optimal Reactive Power Dispatch (ORPD) problem. To address this, a Modified Salp Swarm Algorithm efficiently determines the optimal location and rating of SSSC, comparing results with the IEEE 30-bus system. Our approach aims to minimize power losses, voltage deviations, and improve the voltage profile, demonstrating its effectiveness in optimizing power system operation with SSSC controllers. After solving the ORPD problem and load flow analysis, initial line losses of 119.108 MW (5.8% of total load) reduced to 35.336 MW (1.72% of total load) after including SSSC in INPS. The optimal SSSC size is 58.307 MVA, located on line Lahan to Kusaha, resulting in significant power loss reduction and voltage profile improvement.

Keywords:

Flexible alternating current transmission systems, static synchronous series compensator, Optimal reactive power dispatch, Integrated Nepalese Power System

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Deep Learning-based Forecasting and Bidding Strategies: Analysis of Nepal's Participation in Indian Energy Exchange

Elina Parajuli [a], Basanta Kumar Gautam [b], Nava Raj Karki [c]

Abstract:

Nepal in recent years has been participating in the energy trading on the Indian Energy Exchange (IEX) where it can import and export energy as required by participating in the bidding process. Initially started with the Day Ahead Market (DAM) trading only, Nepal has now also expanded into the Real-Time Market (RTM) since October 2023. However, inaccurate forecasts and Run-off-River Hydro-dominant power system have resulted in significant deviation charges for Nepal as power import/export deviates from scheduled power depending on grid conditions, highlighting the urgent need for improved forecasting accuracy. This underscores the critical importance of precise load forecasting to optimize bidding strategies and reduce deviation charges. To address this challenge, the paper proposes implementing a Deep Neural Network (DNN) model for DAM bidding and a Long Short Term Memory (LSTM) model for RTM bidding. It is shown through analysis that an accurate forecasting through advanced models like the DNN and LSTM is crucial for Nepal to minimize deviation charges, maintain grid stability, and reduce operational costs, highlighting the importance of effective implementation in both RTM and DAM. The DNN model significantly improves forecasting accuracy for generation (91%), load (89%), Market Clearing Price (MCP) (88%), and Tanakpur import/export (80%). Accurate load, generation, and bid forecasting in DAM could minimize deviation charges, while for unforeseen events, RTM takes care of the deviation, offering an additional layer of security and optimization. This paper recommends using LSTM model for adeptly adjusting schedules to real-time requirements, significantly improving the accuracy of Tanakpur bid (98.62%), DM bid (98.9%), and RT MCP (92.06%).

Keywords:

Deviation charges, Deep Neural Network, Forecasting, Real Time Market, Long Short Term Memory, Indian Energy Exchange

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Paper ID: 57

Optimal Coordination of Directional Overcurrent Relays Using Sine Cosine Algorithm

Madhav Prasad Nagarkoti [a], Jeetendra Chaudhary [b], Akhileshwor Kumar Mishra [c]

Abstract:

Integration of the distributed generator (DG)s into the power system and distribution network has increased the complexity of protection coordination. The Optimal coordination of directional overcurrent relay (DOCR)s used for the protection of such networks is highly constrained and nonlinear. A nonlinear optimization technique called Sine Cosine Algorithm (SCA) is used in this paper to solve the optimal coordination problem of the DOCRs. The SCA is a recently proposed algorithm for solving highly nonlinear constrained optimization problems. The method uses the cyclic nature of the sinusoids to reposition a solution around another best solution. This is used to exploit the region defined by the constraints to look for a global optimum value. This work implements the SCA to optimize the coordination problems for the IEEE 3-Bus, 15-Bus and 30-Bus test systems. The result shows the robustness of the algorithm to reduce the total operating times of primary relays while simultaneously maintaining the coordination time intervals (CTI) between the primary and backup relay pairs.

Keywords:

Directional Over-current Relay Coordination, Coordination Time Interval, Distributed Generator, Sine Cosine Algorithm

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Paper ID: 69

Impact of Sampling Rate Variations on Signal Spectrum Based Fault Diagnosis of Induction Motor

Ashish Paudel [a], Nava Raj Karki [b], Basanta Kumar Gautam [c]

Abstract:

The investigation looks into how sampling rate variations affect induction motors fault diagnosis based on signal spectrum analysis. Modern companies depend heavily on induction motors, but they can develop mechanical and electrical problems that, if not found quickly, can result in significant financial loss and downtime. Fault identification relies heavily on signal processing techniques, particularly Motor Current Signature Analysis (MCSA). The Fast Fourier Transform (FFT) technique for frequency spectrum analysis is the main topic of this work. This study investigates how the FFT spectrum is affected when sample rates are changed using decimation and interpolation techniques, with a focus on the diagnosis of broken rotor bar (BRB) problems in induction machines. The methodology involves determining acquisition parameters, calculating the required sampling rate, performing interpolation and decimation, and applying FFT with proper window functions. Spectral leakage, a common issue in FFT-based techniques, is addressed using Hann window function. Experimental results are presented for a healthy motor, a motor with one BRB at different loading conditions, and a motor with BRB at no load. The study compares original sampling rates of 20 KHz obtained from experimental setup in laboratory and with resampled sampling rates using purposed methodology. The findings emphasize the importance of choosing an appropriate sampling rate based on fault visibility and computational efficiency.

Keywords:

Induction Motor, Fault Diagnosis, Broken Rotor Bar, Fourier Transform

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Paper ID: 79

An Explicit Formula Based Estimation Method for Reliability of 11 kV Baneshwor Feeder

Rajesh Kumar Pandey [a], *Nava Raj Karki* [b],
Basanta Kumar Gautam [c], *Rupesh Kumar Sah* [d]

Abstract:

An innovative approach to reliability assessment in the planning phase of medium-voltage distribution systems is presented in this study. The method introduces a new and more accurate technique for estimating reliability indices, enabling their expression through explicit formulas while accommodating various network topologies. Initially, typical feeder structures are identified within the candidate area using a combination of tree edit distance and hierarchical clustering algorithms. Subsequently, for each typical network structure, a reliability evaluation model is established, incorporating factors such as fault isolation, load restoration, and the impact of reliability enhancement equipment, formulated through regression analysis. The feasibility and effectiveness of the proposed reliability assessment algorithm are validated through test cases, demonstrating its capability to achieve rapid and accurate reliability index calculations with minimal data requirements. This approach offers a systematic and efficient means of assessing distribution system reliability during the planning process, ensuring adaptability to diverse network configurations. Finally, this approach is implemented for Baneshwor 11 kV feeder distribution system.

Keywords:

Tree edit distance, reliability estimation, Correlation agglomerative hierarchical clustering (ACH), MATLAB, Regression analysis, medium voltage distribution Feeder

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Paper ID: 87

Power System Contingencies Ranking using Machine Learning

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Anil Sah Baniya [d], *Prabhat Kumar Pankaj* [e]

Abstract:

Power system contingency is a critical concern in ensuring the security, stability and efficiency of electrical grids. Contingency analysis, which evaluates the potential impact of various contingencies on power system operation, plays a crucial role in maintaining reliability. Traditional methods for contingency analysis often rely on deterministic or probabilistic approaches such as Newton Raphson Load Flow (NRLF), although it is accurate but may have limitations in time consuming or computational efficiency. This paper proposes a novel approach utilizing machine learning techniques for power system contingencies ranking. Firstly, calculate performance indices; active power (PIP) and reactive power (PIV) performance index for each line outage condition using NRLF in Matlab. Then, analysis compared the performance of various regression models including Gradient Boosting Regressor, Random Forest, KNN, Decision Tree Regressor, and SVM on predicting two target variables, PIP and PIV. Finally, R-squared scores were used to evaluate model performance. The ranking is made in descending order of most severe contingencies line that has high value of performance index. The proposed methodology is validated through case studies on standard IEEE 14-bus test systems, demonstrating its capability for practical application in power system operation and planning.

Keywords:

Performance indices, contingencies ranking, Newton Raphson Load Flow (NRLF), Matlab, Machine learning

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Paper ID: 21

Evaluating Multiple Linear Regression Prediction Model for Optimum Bitumen Content in Marshall Mix Design

Moti Ram Giri [a], Gautam Bir Singh Tamrakar [b]

Abstract:

Over time, considerable efforts have been committed to enhancing the prediction of Optimum Bitumen Content in Marshall Mix Design to reduce the time and effort required in the conventional Marshall mix design procedure, employing a wide range of factors. Prediction of Optimum Bitumen content continues to be a difficult task due to interactions among numerous variables that are challenging to gather comprehensively. The present study explores the utilization of multiple Linear Regression (MLR) for predicting Optimum Bitumen Content (OBC) in Marshall Mix Design, crucial for optimizing asphalt pavement construction. After the collection of 148 Marshall mix design forms from various projects, the uniqueness of the data is maintained initially; then an outlier test is conducted for the output set, and 141 sets of data were taken for the descriptive statistics analysis to identify the mean, median, mode, and standard deviation of the dataset. After that, a multiple linear regression (MLR) model was developed using Microsoft Excel. For the developed MLR model, the training R-value and R-squared value are 0.849 and 0.7209, respectively, indicating moderate predictive capacity and a strong correlation between independent and dependent variables. Validation on an independent dataset confirms the model's reliability, with an R-value and R-squared value of 0.6734 and 0.4535, respectively and,Chi-Square test suggested that there is no difference between the Actual OBC and Predicted OBC values. ANOVA analysis underscores significant relationships between independent variables and OBC, supported by an F-value surpassing critical thresholds. Sensitivity analysis emphasizes the influential role of aggregate gradations in OBC prediction. By integrating MLR, this research introduces an innovative approach to streamline asphalt mix design processes, offering cost-effective and durable solutions for pavement construction. The findings advocate for widespread adoption of MLR in industry practices to enhance efficiency and resource optimization.

Keywords:

Optimum Bitumen Content, multiple Linear Regression, Marshall Mix Design, Sensitivity Analysis

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Paper ID: 36

Correlation Between CBR Value and Plasticity Index of Base Course Material in Flexible Pavement

Saroj Prasad Shah [a], Gautam Bir Singh Tamrakar [b]

Abstract:

The California Bearing Ratio (CBR) serves as a crucial indicator of base course strength, informing the thickness design of the pavement. It signifies the material's capacity to withstand loads and resist deformation. Plasticity Index (PI) is another pivotal parameter guiding engineers in assessing the suitability of the base course for pavement design. A larger PI implies a higher clay content, potentially compromising the base course's strength and stability. This prompts researchers to explore the potential relationship between CBR and PI. Twenty-one samples of base course were gathered from Lalitpur, Makwanpur, and Dhading, ensuring compliance with the Standard Specifications for Road and Bridge Works, 2016 (SSRBW). In assessing CBR, Optimum Moisture Content (OMC) and Maximum Dry Density (MDD) are also considered. Thus, OMC, MDD, and PI are treated as independent variables to formulate an expression for estimating CBR. Utilizing Multiple Linear Regression in Excel, a predictive model for CBR was established, demonstrating a strong correlation between predicted and observed CBR, with an R^2 value of 0.82. This model streamlines testing procedures by facilitating the determination of CBR values for base courses without extensive testing. Laboratory tests indicate that even with a PI exceeding 6 (e.g., PI = 8), the CBR value remains above 80%. This underscores the negative correlation between CBR and PI, suggesting that as PI increases, the CBR value tends to decrease. Moreover, during the validation of the research, Root Mean Square Error (RMSE) values for the estimated CBR compared to the observed CBR were determined as 4.49. This underlines the model's effectiveness in CBR determination and underscores its potential to save time and resources. Adopting this model could significantly enhance its reliability for practical application in road construction projects.

Keywords:

CBR, PI, MDD, OMC, Base, SSRBW, Correlation

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Paper ID: 37

Modelling Pedestrian-Vehicle Conflict and Severity at Uncontrolled Midblock Crossings Inside Kathmandu Valley

Ashish Banstola [a], *Pradeep Kumar Shrestha* [b]

Abstract:

Pedestrian safety at uncontrolled urban midblock crossings is a critical prerequisite for sustainable urban transport. Evaluation of factors affecting pedestrian-vehicle conflict helps designers to proactively implement warrants to reduce the risk at such crossings. This study uses pedestrian safety margin(PSM),a surrogate safety measure, to further define scenarios of conflict and severity. The contributing factors for occurance of conflict were modelled and analyzed through binary logistic regression. In addition, an ordinal logit model was also developed to examine their influence on probability of occurance of 4 different levels of severity of conflict whose thresholds were defined on the basis of Pedestrian Vehicle Scaled Risk Indicator(PVSRI). Results show remarkable goodness of fit for conflict model ($AUC = 0.91$,$A = 84\%$) and ordinal severity models ($A = 61\%$). Pedestrian speed,waiting time,vehicle type,pedestrian group size,accepted vehicular gap size,nature of crossing and lane position were found to have significantly impacted the odds of conflict and higher severity.

Keywords:

Safety Margin,Pedestrian-Vehicle Conflict,Binary Logistic Regression,Ordinal Logistic Regression,Conflict Severity

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Paper ID: 38

Mixed Logit and Probit Model for Intercity Mode Choice in Nepal.

Arjun Sigdel [a], Jagat Kumar Shrestha [b]

Abstract:

Modal balance of different transportation mode is important prerequisite for ensuring sustainable transportation. The effect of economic progress made by nation is reflected through change in consumption and behavioral attitude of general population. In transportation sector, it is best identified by preference of more comfortable, reliable and fast transportation mode by transportation users. Therefore, it is important for transportation professional to understand the socio-economic, behavioral, mode specific system variable for efficient management of existing transportation mode and for developing new mode of transportation. Experience of East Asian Mega city shows intercity transportation and understanding the modal share of intercity transport will be of particular importance. Transportation infrastructure is one time large capital investment. Therefore, it is important for transportation planner to project the ridership new transportation mode will generate. Intercity mode choice study is important for understanding economic viability of transportation infrastructure. Traditionally, aggregate modelling was used for mode choice study. Due to the inability of aggregate model to factor individual level data, discrete choice models are used for mode choice analysis of late. This work uses multinomial probit and mixed logit model for study of mode choice of intercity travellers of Nepal. Effect of different system attributes variables and socio-economic variables on mode choice for intercity travel in Nepal is done in this study. Also, this study will give value of time for plane and car user in monetary terms.

Keywords:

Discrete Choice Model, Intercity Transport, Probit Model, Mixed Logit Model, Value of Time

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Paper ID: 59

Spatial Analysis of Road Traffic Crash Hotspots in Kathmandu Valley, Nepal

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Abstract:

Kathmandu Valley is one of the rapidly urbanizing cities in Nepal, which registers the highest incidence of road traffic crashes compared to other regions in the country. The current paper aims to demonstrate the applicability of Geographic Information System (GIS) oriented spatial analysis techniques to characterize the spatial patterns of the crash hotspots in the Valley. Within this study, a fusion of spatial autocorrelation (Global Moran's I Index), Getis-Ord Gi* statistic and Kernel Density Estimation (KDE) methods were applied to analyze the three years of crash data (2019-2021) on aggregate basis. A positive value (0.28) of Moran's I Index indicated that the crashes were clustered spatially with high significance. The Getis-Ord Gi* measure identified the highly significant hotspot segments along the Valley roads at 99% confidence level. The KDE visualization corroborated the hotspot links generated by the Getis-Ord Gi* statistics. The hotpots were further ranked based on weightages relative to severity level. The results showed that the hotspots are concentrated along Ring Road, Tribhuwan Highway, Araniko Highway and feeder roads. The findings of this study will serve useful evidence for traffic safety management agencies to prioritize these specific locations and implement targeted interventions to enhance safety of these road segments.

Keywords:

Traffic Crashes, GIS, Spatial Analysis, Hotspots, Moran's I, Getis-Ord Gi*, KDE, Severity

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