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| S/N | Journal/Paper with Author & Date | Problem solved/addressed | Methods used | Results obtained | Strength of method used | weakness of method used | Gaps in knowledge | Remarks |
|  | Power outage prediction by using logistic regression and decision tree.  Alia Yasmin Nor Saidi et al. (2021) | Predicting power outages | Logistic regression and decision tree | Fine Tree is the most suitable model to be used for the prediction of power outage. | Fine Tree has the highest value of AUC. | Logistic Regression and Coarse Tree shows the lowest value of AUC compared to the other model. | The results could be improved if the datasets obtained provide more data without any missing values. | This is an article about power outage prediction using machine learning. It discusses the factors that can trigger power outages, such as lightning, weather, or animals. The authors propose a method for predicting power outages using logistic regression and decision tree. The results show that Fine Tree is the most suitable model for predicting power outages. |
|  | Outage prediction models for snow and ice storms.  Diego Cerrai, Marika Koukoula, Peter Watson, Emmanouil N. Anagnostou  (2020) | Predicting outages caused by snow and ice storms | Machine learning (ML) and generalized linear models (GLMs) | Both models have median absolute percentage errors around 70%. The GLM is better at predicting extreme events, while the ML model is better at predicting lower impact events | The methods used are able to predict outages with reasonable accuracy. | The methods used are not perfect and can sometimes make mistakes.. | How to improve the accuracy of the models. | The models are a valuable tool for utilities and can help them to prepare for and respond to snow and ice storms. |
|  | Application of Geographic Information System to Power Distribution System Analysis.  Yusuke Kakumoto et al.  (2016) | Analyzing the impact of photovoltaic (PV) generation on power distribution systems | Geographic Information System (GIS) | GIS can be used to accurately evaluate the amount of solar radiation falling on PV panels, which can then be used to estimate PV generation. | GIS is a powerful tool that can be used to analyze a wide range of data. | GIS can be complex and expensive to use. | More research is needed to develop methods for using GIS to analyze PV generation in different types of power distribution systems. | This paper presents a new application of GIS in the field of electric power engineering. The authors show that GIS can be used to accurately evaluate the amount of solar radiation falling on PV panels, which can then be used to estimate PV generation. This information can be used to improve the planning and operation of power distribution systems. |
|  | Enhancing Weather-Related Power Outage Prediction by Event Severity Classification.  Peter Watson, et al.  (March 2020) | Improving the accuracy of machine learning-based power outage prediction models (OPMs) for weather-related events | A novel method called “Conditioned OPM” that divides an OPM training dataset into subsets of events representative of the predicted event’s severity | The proposed method was tested on 102 storm events and found to be accurate. | The method is able to improve the accuracy of OPMs by taking into account the severity of the predicted event. | The method requires a large amount of historical data to be effective. | More research is needed to develop methods for using event severity classification to improve the accuracy of OPMs for other types of weather-related events. | This research is a valuable contribution to the field of power outage prediction. The proposed method is a promising new approach to improving the accuracy of OPMs for weather-related events. |
|  | Developing an Algorithm on the Reporting Of Outages in the Electricity Distribution System with GIS Integration.  Ahmet Bahadır ÜNVERDİ, Aziz ŞİŞMAN (November 2020) | Analyzing and reporting outages in Electricity Distribution Systems with GIS integration | Geometric network creation in GIS.  Integration with Outage Management Systems (OMS) and Distribution Management Systems (DMS) | Precise information or location about outages.  Identification of affected customers.  Reliable results due to GIS integration | Utilizes GIS for spatial and non-spatial data analysis, creates a geometric network for precise outage analysis and integrates with various information systems | Requires instant operation for accurate results. May be complex if switching element positions change frequently | No indication of whether the algorithm leverages machine learning or predictive analytics techniques for enhancing outage prediction and analysis. | The algorithm provides a valuable approach to outage reporting and analysis. Further optimization for real-time applications and addressing challenges in switching element changes could enhance practical implementation. |
|  | Using Spatial Analytics to Investigate Electric Power-Outage Events.  Vivian Sultan, Brian Hilton.  (January 2020). | Understanding the causes of power outages to improve grid reliability | Spatial analytics framework using GIS data and statistical methods | Identification of areas more likely to experience power outages | Ability to identify patterns in power-outage events | Requires large amounts of data and computational resources | Need for further research on the effectiveness of spatial analytics for preventing power outages | Spatial analytics can be a valuable tool for understanding and preventing power outages |
|  | Analyzing Electric Power Outage Data and Predicting Outages for Texas.  R. Wang  (2022) | Analyzing factors that affect electric power outages and predicting outages for Texas | Machine learning and time series methods | Models that consider both weather and Electric Reliability Council of Texas (ERCOT) data are more accurate than those that consider only one | Ability to consider multiple factors that affect outages | Requires large amounts of data and computational resources | Need for further research on the effectiveness of machine learning and time series methods for predicting outages | Machine learning and time series methods can be valuable tools for analyzing and predicting power outages |
|  | Quantifying Uncertainty in Machine Learning-Based Power Outage Prediction Model Training: A Tool for Sustainable Storm Restoration. Feifei Yang, David W. Wanik, Diego Cerrai, Md Abul Ehsan Bhuiyan, Emmanouil N. Anagnostou.  (2020) | Quantifying uncertainty in machine learning-based power outage prediction models | Devised a randomized and out-of-sample validation experiment to quantify an OPM's prediction uncertainty to different training sample sizes and event severity representativeness. | Showed random error decreasing by more than 100% for sample sizes ranging from 10 to 80 extratropical events, and by 32% for sample sizes from 10 to 40 thunderstorms. | Quantified the minimum number of sample size for the OPM attaining an acceptable prediction performance | The proposed method is limited by the availability of historical data. | Did not consider the impact of other factors such as the specific type of storm, the location of the utility network, and the age of the infrastructure. | Need for further research on the effectiveness of the proposed method for improving the accuracy of power outage predictions. |
|  | Power Outage Prediction for Natural Hazards Using Synthetic Power Distribution Systems.  Chengwei Zhai, Thomas Ying-jeh Chen, Anna Grace White, Seth David Guikema  (May 2020) | Predicting power outages for natural hazards at the building level | A new method that uses a synthetic power distribution system to make predictions at the building level | The method was accurate when tested on two cities | The method can provide more localized predictions of power outages than traditional methods | The method requires a lot of data | More research is needed to develop methods that do not require as much data | This is a valuable contribution to the field of power outage prediction. The new method has the potential to improve the accuracy of power outage predictions and make them more useful for natural disaster preparedness. |
|  | Predicting Electricity Distribution Feeder Failures Using Machine Learning.  Philip Gross et. Al  (2006) | Predicting electricity distribution feeder failures in New York City | A machine learning system called ROAMS to rank feeders according to their susceptibility to failure | The results obtained by the ROAMS system are very promising. In the summer of 2005, the system was able to correctly identify 75% of the feeders that failed. |  |  | More research is needed to develop methods that do not require as much data | The paper applies an ML system known as ROAMS system to rank the feeders most susceptible to impending failure with sufficient accuracy so that timely preventive maintenance can be taken on the right feeders at the right time. |
|  | Improving the Prediction of Power Outages Caused by Extreme Weather Events.  Peter L. Watson, Aaron Spaulding, Marika Koukoula, Emmanouil Anagnostou (2022) | Improving the prediction of power outages caused by extreme weather events | A large dataset of storms and predictor variables were used. Different methods for managing the statistical distribution of the target variable were tested. | A natural log-transformation and SMOTE for Regression were the most effective. The best performing model was able to predict storm impacts with an R 2 score of 0.82. | Method uses many meteorological factors in the impacts of extreme events. This information can be used to improve the accuracy of power outage predictions | Method is difficult to interpret because of the large size of the feature space, making it difficult to understand which factors are most important for predicting power outages. | Approach is complex and requires very accurate methods for classification and does not manage redundant information across variables | This is a valuable contribution to the field of power outage prediction. The methodology has the potential to improve the accuracy of power outage predictions and make them more useful for disaster preparedness. |
|  | A Spatial Prediction Algorithm for Power Outages Caused by Typhoons.  Hui Hou, Shaohua Zhu, Hao Geng, Min Li, Yufeng Xie, Ling Zhu, Yong Huang  (2021) | Predicting the spatial distribution of power outages caused by typhoons | A random forest algorithm and a two-stage prediction model | The proposed method can achieve an accuracy of 92.44% | The proposed method is accurate and can be used to predict the location and extent of power outages caused by typhoons | The proposed method is complex and requires a lot of data | More research is needed to develop methods that are even more accurate and require less data | The paper proposes a novel algorithm for assessing the spatial distribution of power outages caused by typhoons. The proposed method considers multiple factors that influence outages, including meteorological data (typhoon intensity and wind speed), geographical data (terrain and vegetation), and power grid data (infrastructure and historical outage records) |
|  | A Case Study on Power Outage Impacts from Future Hurricane Sandy Scenarios.  D.W. Wanik et al.  (Jan 2018) | Assessing the potential impacts of future Hurricane Sandy scenarios on power outages | A high-resolution ensemble modeling framework was used to simulate future Hurricane Sandy scenarios. The Weather Research and Forecasting (WRF) model was used to simulate the atmospheric conditions, and the Regional Atmospheric Chemistry Mechanism (RACM) model was used to simulate the air quality. The results were then used to drive the Power Outage and Restoration Simulation (PORSim) model to simulate the impacts on the power grid. | The results showed that future Hurricane Sandy scenarios could cause widespread power outages, with some areas experiencing outages for up to two weeks. The results also showed that the impacts of the outages would be significantly larger than those of Hurricane Sandy. | The method used is a state-of-the-art ensemble modeling framework that is able to simulate a wide range of atmospheric conditions and power grid components. | Method is computationally expensive and requires a lot of data. This means that it may not be practical to use for real-time forecasting or for assessing the impacts of power outages on a large scale. | Method is based on a number of assumptions, such as the assumption that the power grid will behave in the same way in the future as it does today. These assumptions may not be valid, and they could lead to inaccurate results. | The paper shows that future Hurricane Sandy scenarios could cause widespread power outages, and the impacts of the outages would be significantly larger than those of Hurricane Sandy. |
|  | Development of an Enterprise Geographic Information System (GIS) Integrated with Smart Grid.  Atefeh Dehghani Ashkezari, Nasser Hosseinzadeh, Ayoub Chebli, Mahammed Albadi  (March 2018) | Developing an enterprise Geographic Information System (GIS) integrated with smart grid | A pilot project was conducted at Sultan Qaboos University (SQU). The system provides real-time monitoring of the electricity grid. It also enables control, asset management, and demand side management. The GIS data model and web application were developed in two phases. The system is able to collect data from distributed energy resources (DERs). The data is then stored in a database and can be accessed by users through a web interface. | The system was able to successfully collect data from DERs and provide real-time monitoring of the electricity grid. | Real-time monitoring of the electricity grid, demand side management | Expensive, requires specialized training to use | Does not cover the entire electricity network and does not include all of the data that is needed for smart grid management | The development of an enterprise GIS integrated with smart grid is a valuable step towards the development of a more reliable electricity grid. Overall, the system is a promising development that has the potential to improve the management and operation of the electricity grid. |
|  | A Novel Approach for the Three Phase Power Failure Prediction Model Using AI/ML.  Sathish Kumar N, Harish K G, Kannan B, Jaya Anand N.  (2023) | Correlation between Cold Weather Meteorological Variables and Electricity Outages | Random Forest Machine Learning, Pearson’s correlation coefficient | Results show improved predictability with larger and combined datasets, emphasizing the importance of data quality and suggesting avenues for future exploration of more sophisticated correlation methods. | Random Forest demonstrated ability to predict electricity outages based on weather variables. The use of Pearson's correlation coefficient added a statistical measure to evaluate the relationship between weather variables and outages, providing a comprehensive approach to understanding their correlation patterns. | Pearson's correlation coefficient captures linear correlation and may overlook more complex relationships in the data. Additionally, the study acknowledges the need for further exploration of external factors beyond meteorological variables that could contribute to outages, indicating potential limitations in the scope of variables considered. | External factors not considered (e.g., infrastructure). | Encouraging results for prediction improvement with more data. |
|  | A Systematic Framework for Integrating Weather Data into Prediction Models for the Electric Grid.  Mladen Kezunovic , Zoran Obradovic, Tatjana Dokic, Shoumik Roychoudhury.  (2018). | Improving the accuracy of power outage predictions | Proposed a weather impact model (WIM) that can be used to predict outages and manage assets | Proposed prediction model showed promising results where the average AUC was larger than 0.75 for all cases. The unified prediction model showed better results than models developed for the individual applications. | The WIM is based on a logistic regression model embedded in a geographic information system (GIS). This makes the WIM a powerful tool for predicting outages, as it can take into account a wide range of factors that can influence outages, such as weather, geography, and the power grid itself. | The WIM is dependent on the quality and completeness of the input data. If the input data is inaccurate or incomplete, the WIM will not be able to make accurate predictions. | More research is needed to enhance the method's generalizability and applicability to different regions and weather conditions. The WIM was only tested in one region, and it is not clear how well it would perform in other regions with different weather patterns. | The WIM offers a promising tool for improving power outage prediction accuracy and asset management |
|  | Evaluating and Visualizing the Economic Impact of Commercial Districts Due to an Electric Power Network Disruption.  Mohammed Ghiasi et al.  (November 2018). | Assessing the economic impact of outages on commercial districts | Proposed a method that combines geographic information systems, an economic evaluation, and a visualization to evaluate the economic impact of outages on commercial districts | The proposed method was able to identify the most vulnerable commercial districts and the economic impact of outages on those districts | The proposed method is a comprehensive approach to evaluating the economic impact of outages on commercial districts | The proposed method requires a lot of data and can be computationally expensive | The method is based on a number of assumptions, such as the assumption that all businesses in a commercial district are equally vulnerable to outages. This assumption is not always valid, and it could lead to inaccurate results. | This is a valuable contribution to the field of infrastructure resilience. The proposed method can be used to inform the development of new mitigation and adaptation strategies |
|  | **Failure Risk and Outage Prediction in Power Systems under Wind Hazards.**  **Hui Hou et al.**  **(September 2022).** | **Improving the accuracy of outage prediction models in power systems under wind hazards** | **Compared circulation and translation wind speed. Introduced wind-induced component failure models. Used the series reliability model to analyze multiple cluster failures. Used statistical learning methods and machine learning methods to develop data-driven outage prediction models.** | **Developed data-driven outage prediction models that can be used to predict outages in both transmission and distribution systems.** | **The method can be used to predict outages in both transmission and distribution systems.** | Method requires a lot of data to train the models. This means that it may not be practical to use for real-time outage prediction. | More research is needed to develop methods for real-time outage prediction. This includes developing methods for collecting and processing data in real time and developing methods for predicting outages that are computationally efficient | Proposed method is a valuable contribution to the field of power system reliability. The results of the study can be used to inform the development of new mitigation and adaptation strategies. However, the method has some limitations that need to be addressed before it can be widely adopted. |
|  | Spatial generalized linear mixed models of electric power outages due to hurricanes and ice storms.  Haibin Lui. et al.  (2008). | Predicting electric power outages caused by hurricanes and ice storms | Developed spatial generalized linear mixed models (SGLMMs) to predict electric power outages | Developed two new spatial generalized linear mixed models (SGLMMs) that can be used to predict the number of power outages that will occur in each 3 km x 3 km grid cell in a region due to a hurricane or ice storm. | The SGLMMs incorporate spatial correlation and can account for overdispersion | Method requires a lot of data and is computationally intensive. | More research is needed to develop methods for real-time outage prediction | The models are a valuable tool for power companies that can be used to plan for and respond to hurricanes and ice storms. |
|  | Improving the Resiliency and Reliability of the Power Grid in the Time of COVID-19.  A. Yousefi, A. Hadi-Vencheh. (March 2023) |  | The authors propose a new methodology to improve reliability of the power grid by using artificial intelligence and the integrated clustering model. The clustering model is used to identify and group power grid components that are likely to fail together. This information is then used to develop a predictive maintenance schedule that can help to prevent power outages. | Findings show that the system average interruption duration index (SAIDI) decreased by an average of 23%. This means that the average length of time that customers were without power decreased by 23%. | Strength of the method used is that it is able to identify and group together power grid components that are likely to fail together. This information can then be used to develop a predictive maintenance schedule that can help to prevent power outages. | The weakness of the method used is that it is based on historical data. This means that the method may not be able to predict power outages that are caused by new or unforeseen events. | Need for more research on the impact of extreme weather events on the power grid. Additionally, there is a need for more research on development of new technologies that can improve the resiliency and reliability of the power grid. | Findings of this paper suggest that the use of artificial intelligence and the integrated clustering model can be an effective way to improve the resiliency and reliability of the power grid. |
|  | Risk Analysis and Management in Power Outage and Restoration: A Review.  Anya Castillo (February 2014) | Power outages can have a significant impact on society and the economy. There is a need for better risk analysis and management to improve power grid resiliency. | P**robabilistic risk assessment (PRA), Failure mode and effects analysis (FMEA), Monte Carlo simulation** | Research concludes that there is no single best approach to risk assessment. The best approach will vary depending on the specific application. However, all of the approaches reviewed in the article can be useful for improving power grid resiliency. | Strength of the methods used is that they provide a quantitative assessment of power outage risk. This information can be used to make informed decisions about how to improve power grid resiliency. | The weakness of the methods used is that they are based on a number of assumptions. These assumptions can introduce uncertainty into the risk assessment. | Lack of data on the frequency and duration of large-scale blackouts. This makes it difficult to assess the overall impact of these events and the challenge of quantifying the human costs of power outages | Paper provides a valuable overview of the different approaches that have been used to assess power outage risk. The article also highlights the importance of risk analysis and management for improving power grid resiliency. |
|  | Using Vegetation Management and LiDAR Data to Improve Outage Predictions for Electric Utilities.  D.W.Wanik et al  (May 2017) | Paper proposes a method for using vegetation management and LiDAR data to improve outage predictions for electric utilities. | Authors developed LiDAR data product called “ProxPix” to measure vegetation that is tall enough to strike overhead powerlines. They used this data, along with other vegetation management and infrastructure data, to evaluate an outage prediction model. | Authors found that models that included ProxPix data performed better than simpler models. | The use of LiDAR data to measure vegetation is a novel and promising approach to improving outage predictions | Study is limited to outages occurring during Hurricane Sandy in eastern Connecticut. Further research is needed to investigate the generalizability of the findings to other regions and storm types. | Study does not consider the impact of vegetation management on infrastructure costs, which is an important factor for utility companies. | Paper provides valuable insights, however further research is needed to address the limitations of the study and to develop more generalizable recommendations. |
|  | Article discusses how GIS can be used to improve power distribution and forecast load growth.  BM AL-Ramadan (2013). | Article provides an overview of GIS and its applications in electrical power systems. | The article concludes that GIS is a valuable tool for electrical power systems. | The article concludes that GIS is a valuable tool for electrical power systems. | The article provides a comprehensive overview of GIS and its applications in electrical power systems. | The article does not provide specific examples of how GIS has been used to improve power distribution and forecast load growth. | More research is needed to quantify the benefits of using GIS in electrical power systems. | GIS is a powerful tool that can be used to improve the efficiency and reliability of electrical power systems. |
|  | Using VIIRS Day/Night Band to Measure Electricity Supply Reliability: Preliminary Results from Maharashtra, India.  Michael L. Mann et al.  (29 August 2016). | Unreliable electricity supplies are a major problem in developing countries. This paper proposes a machine-learning approach to estimate electricity reliability using satellite imagery of nighttime lights. | The authors use a random forest machine-learning algorithm to train a model to predict electricity reliability from satellite imagery of nighttime lights. They use data from India to test their approach. | The authors' results show that their approach is promising. The model is able to predict electricity reliability with an accuracy of 80%. | The use of satellite imagery is a novel and promising approach to measuring electricity reliability. | The model is only able to predict electricity reliability at a coarse spatial resolution. | More research is needed to develop methods to predict electricity reliability at a finer spatial resolution. | The use of satellite imagery has the potential to revolutionize the way we measure electricity reliability in developing countries. This could lead to improved planning and investment in electricity infrastructure. |
|  | Using a Geographic Information System (GIS) to Plan Substations and Feeders.  W.M. Lin, M.T. Tsay, S.W. Wu.  (March 1996) | The paper discusses a method for using a geographic information system (GIS) to plan substations and feeders. | The paper proposes a method that uses the shortest path to determine substation siting and feeder planning. | The article demonstrates that the proposed method can be used to effectively plan substations and feeders. | The proposed method is a simple and efficient way to plan substations and feeders. | The proposed method does not consider all of the factors that may need to be considered when planning substations and feeders. | More research is needed to develop methods that can consider all of the factors that may need to be considered when planning substations and feeders. | The use of a GIS can be a valuable tool for planning substations and feeders. |
|  | Modeling Electric Power and Natural Gas System Interdependencies.  Edgar C. Portante.  (September 12, 2017) | Paper discusses importance of infrastructure resilience and the need for better modeling to understand and mitigate cascading failures in electric power and natural gas systems. | The authors present a new assessment framework that integrates existing electric power and natural gas system simulation models. This framework can be used to assess the impact of disruptions on critical infrastructure systems. | Framework was able to be applied to two case studies, the State of Florida and the State of North Dakota, to assess the impact of disruptions on critical infrastructure systems. | Framework is able to integrate a wide range of data and models, which makes it a versatile tool for assessing infrastructure resilience. | Framework does not explicitly consider the impact of cascading failures on other critical infrastructure systems, such as transportation and communication systems. | Need to understand the complex interactions between different critical infrastructure systems and assess the cumulative impact of multiple disruptions on critical infrastructure systems. | The development of better models to understand and mitigate cascading failures is critical for ensuring the resilience of critical infrastructure systems. |
|  | Data-driven prediction method for power grid state subjected to heavy-rain hazards.  S Oh, J Kong, M Choi, J Jung (8 July, 2020). | Power grid outages can have a significant impact on society, causing disruptions to businesses and homes. This paper proposes a method for using Support Vector Machines (SVM) to predict power grid outages. | The authors used SVM to predict outages based on 10 years of historical weather data. They used the radial basis kernel function and compared the performance of SVM to other machine learning algorithms. | The authors found that SVM was 87.2% accurate. This was significantly better than the performance of other machine learning algorithms. | SVM is a powerful machine learning algorithm that has been shown to be effective in a variety of applications. The radial basis kernel function is a popular choice for SVM classification tasks. | SVM can be computationally expensive to train. The radial basis kernel function can be sensitive to outliers in the data. | Study only considers historical weather data as a predictor of power grid outages. Other factors that may contribute to outages, such as aging infrastructure and cyberattacks, are not considered. | SVM is a promising tool for predicting power grid outages. This could lead to improved grid management and reduced outage costs. |
|  | Data-driven spatio-temporal analysis of wildfire risk to power systems operation.  Amarachi Umunnakwe (May 2022) | Paper proposes a data-driven spatio-temporal analysis framework to predict wildfire ignition and assess the potential impact of wildfires on power systems. | Deep neural network is trained on historical wildfire data and environmental factors to predict the spatio-temporal probability of wildfire ignition and power grid risk assessment model is used to simulate the potential impact of wildfires on power systems, considering factors such as wildfire location, intensity, and grid topology. | Wildfire ignition prediction model achieved high accuracy in predicting wildfire locations and times and power grid risk assessment model effectively simulated the impact of wildfires on power systems, identifying critical infrastructure components at risk. | The proposed framework leverages deep learning and power systems modeling to provide a comprehensive approach to wildfire risk assessment for power systems. | Framework's performance may depend on the availability and quality of historical wildfire data and the accuracy of the power grid model. | Develop more sophisticated models for wildfire ignition prediction that incorporate real-time data sources and complex environmental factors, enhance power grid risk assessment model to account for the dynamic nature of power systems and the potential for cascading failures. | The proposed framework provides a valuable tool for power grid operators to assess and mitigate wildfire risk, contributing to the resilience of critical infrastructure. |
|  | Simulation of supply chain disruptions considering establishments and power outages.  Hiroyasu Inoue, Yoshihiro Okumura,Tetsuya Torayashiki,Yasuyuki Todo. (July, 2023) | The article discusses the importance of using establishment-level data to improve the accuracy of simulations of supply chain disruptions. | The authors’ method uses data from an establishment-level survey, the establishment-level census data in Japan, and detailed geographic information system (GIS) data. It also incorporates the effect of power outages. | Results achieved were that the extended method was able to significantly improve the accuracy of predicting the production of Japan after the GEJE | The use of establishment-level data is a novel and promising approach to simulating supply chain disruptions. | The method is limited by the availability of establishment-level data. | More research is needed to develop methods that can incorporate other factors that affect supply chain disruptions, such as transportation disruptions and labor shortages. | The use of establishment-level data can improve the accuracy of simulations of supply chain disruptions. This could lead to better preparedness for future disasters. |
|  | Identification of system vulnerabilities in the Ethiopian electric power system.  Moges Alemu Tikuneh, Getachew Biru Worku.  (August 2018). | Paper discusses importance of the power system to the country’s economy and social welfare. Authors propose a method for assessing the vulnerability of the power system using two indices. | Authors propose a method for assessing the vulnerability of the power system using two indices: L**ine Outage Vulnerability Index (LOVI)**: This index measures the impact of line outages on the power system.  **Bus Voltage Vulnerability Index (BVI)**: This index measures the impact of bus voltage drops on the power system. | Authors find that the most severe line outages are those that interconnect the high load centered regions with the rest of the country. They also find that the most vulnerable buses of the network are mainly found at the high load centers. | Proposed method is a novel, promising approach to assess the vulnerability of power system. The use of two indices provides a comprehensive assessment of the power system’s vulnerability. | Proposed method does not consider all of the factors that may contribute to power system vulnerabilities, such as cyberattacks and natural disasters. | More research is needed to develop methods for assessing the vulnerability of the power system to a wider range of threats. | Assessment of power system vulnerability is an important step in improving the reliability and security of the power system. The proposed method is a valuable tool for assessing the vulnerability of the Ethiopian power system. |
|  | Optimal production with uncertain interruptions in the supply of electricity: Estimation of electricity outage costs  Asher Tishler.  (August 1993) | Paper discusses the cost of electricity outages in the industrial and commercial sectors. The author proposes a model to measure expected electricity outage costs. | The author develops a model that takes into account the following factors: four sources of electricity outage costs: foregone profits, reduced productivity, material damage, and labor costs, random nature of electricity outages, business customer's ability to respond to electricity outages. | Author finds that the expected cost of an electricity outage is a function of the following factors: length of the outage, time of day, day of week of outage and type of business customer. | Proposed model is a novel and promising approach to measuring expected electricity outage costs. The model takes into account a number of important factors that have been neglected in previous studies. | Proposed model is based on a number of assumptions that may not be valid in all cases. For example, the model assumes that the business customer can perfectly predict the cost of an electricity outage. | More research is needed to:  Validate the assumptions of the proposed model, develop methods for measuring the cost of electricity outages for different types of businesses. | The proposed model is a valuable tool for measuring expected electricity outage costs. This information can be used by businesses to make informed decisions about their electricity consumption and outage preparedness. |
|  | Using Machine Learning Methods to Forecast the Number of Power Outages at Substations.  Chulpan Minnegalieva and Alina Gainullina  (2023) | Paper proposes a solution for forecasting power outages due to natural factors. Authors address the problem of forecasting power outages at substations using machine learning methods. | Authors used five different binary classification algorithms to forecast power outages: FastTree, binary logistic regression using the stochastic dual coordinate ascent method (SdcaLogisticRegression), field-aware machine factorization model trained using the stochastic gradient method (FieldAwareFactorizationMachine), a linear logistic regression model trained using the L-BFGS method (LbfgsLogisticRegression), and binary classification using generalized additive models (GAM). | The authors found that binary classification using generalized additive models (GAM) gave the best result. The model was able to accurately predict power outages with a high degree of accuracy. | The strength of the method used is that it is able to accurately predict power outages with a high degree of accuracy. The method is also relatively easy to implement and can be used with a variety of data sets. | It requires a large amount of data to train. The method may also not be as accurate in forecasting power outages in areas with different weather patterns. | Need for more research on how to forecast power outages in areas with different weather patterns. Another gap is the need for more research on how to combine machine learning methods with other forecasting methods. | Authors have developed a method that can be used to accurately forecast power outages with a high degree of accuracy. The method is also relatively easy to implement and can be used with a variety of data sets |
|  | Electric Substation Emergency Disaster Response Planning Through the Use of Geographic Information Systems.  Vivian Sultan, Au Vo, Brian Hilton  (2018) | Paper proposes a solution for identifying critical facilities that would be affected by power outages at substation using Geographic Information Systems (GIS). | Authors used GIS to create a map of the San Gabriel Valley area of Los Angeles County, Southern California. They then located all nursing homes, urgent care facilities, power substations, and power lines in the vicinity. They then performed spatial joins to create linkages between them. Finally, they used color-coding to separate each power substation and its connected facilities. | Authors found that GIS could be used to effectively identify critical facilities that would be affected by power outages at substations. The map created showed the locations of all nursing homes, urgent care facilities, power substations, and power lines in the San Gabriel Valley area. The color-coding made it easy to see which facilities were connected to which substations. | Method is easy to use and understand. The GIS map is easy to read and the color-coding makes it easy to see which facilities are connected to which substations. | Method does not take into account the specific needs of each facility. For example, a nursing home may have different needs than an urgent care facility. | Authors identify several gaps in knowledge related to identifying critical facilities that would be affected by power outages at substations. One is the need for more research on how to prioritize critical facilities based on their specific needs. Another is the need for more research on how to use GIS to model the spread of power outages. | Paper provides a valuable contribution to the field of emergency response planning. Method is easy to use and understand and can be used to inform emergency responders about which facilities need to be attended to first. The paper also identifies several gaps in knowledge that need to be addressed in future research. |
|  | Machine Learning and GIS Approaches for Electrical Load Assessment  Alessandro Bosisio et al.  (8 July 2021). | The paper proposes a machine learning approach that uses GIS data to improve the accuracy of electrical load assessments for distribution system operators (DSOs). | The authors used three regression algorithms: regression tree, least-squares boosting, and random forest. They trained these algorithms on a dataset of GIS data and electrical load data. | The results of the study show that the proposed approach is able to improve the accuracy of load assessments by up to 20%. | Method is able to improve the accuracy of load assessments. This is important for DSOs because it can help them to better manage their distribution systems. | The weakness of the method used is that it requires a large amount of data to train the machine learning algorithms. This may not be available for all DSOs. | Need for more research on how to use these approaches to assess electrical load at different levels of granularity and for more research on how to use these approaches to assess electrical load in different types of distribution systems. | Paper provides a valuable contribution to the field of electrical load assessments.  Authors developed a method that is able to improve the accuracy of load assessments. This method is based on the use of machine learning and GIS data. The paper also identifies several gaps in knowledge that need to be addressed in future research. |
|  | Developing a Weather-Related Power Outage Prediction Model.  Peter L. Watson, Diego Cerrai, Marika Koukoula, David W. Wanik, Emmanouil Anagnostou.  (October 2020) | Paper proposes model for predicting outages based on weather data. Authors address the problem of predicting power outages, which can cause significant disruptions to businesses and communities. | Authors developed a machine learning model that uses weather data to predict power outages. They trained the model on a dataset of historical weather data and power outage data from five utility service territories. | The results of the study show that the proposed model is able to predict power outages with high accuracy. The model was able to correctly predict 80% of power outages in the test dataset. | Method is able to predict power outages with high accuracy. This is important for utility companies because it can help them to prepare for and respond to power outages. | It requires a large amount of historical data to train the machine learning model. This data may not be available for all utility companies. | Need for more detailed studies that can identify the specific types of weather events that are most likely to cause outages, as well as the factors that make certain power systems more vulnerable to outages. | Innovative approach offers significant benefits to utility companies by enabling proactive preparations and timely responses to weather-induced disruptions. |
|  | Bayesian Assessment of Electrical Power Transmission Grid Outage Risk.  Tomas Iešmantas, Robertas Alzbutas  (June 2014) | Paper proposes a Bayesian approach to assessing electrical power transmission grid outage risk. The authors address the problem of the lack of a unified approach to assessing grid outage risk when considering uncertain data. | The authors developed a Bayesian hierarchical model to analyze statistical data of grid outages. This model considers the spatial and temporal dependencies of grid outage | Proposed Bayesian hierarchical model was able to effectively assess power transmission grid outage risk. Model was able to identify the factors that most contribute to grid outages, such as geography and environment related variability. Model was also able to simulate large blackouts. | Method is able to effectively assess electrical power transmission grid outage risk under uncertainty. This is important for power grid operators because it can help them to make informed decisions about how to improve grid reliability. | While Bayesian models offer powerful risk assessment capabilities, their complexity can make it challenging to interpret the results and identify the underlying factors driving outage risks. | Need to integrate real-time data from sensors and monitoring systems to enhance the model's ability to reflect current grid conditions and provide more accurate outage risk assessments. | Bayesian assessment offers a promising approach to evaluating electrical power transmission grid outage risk under uncertainty, but further research is needed to address data limitations, incorporate real-time information, and enhance model interpretability. |
|  | Multi-target prediction model of urban distribution system rainfall-caused outage based on spatiotemporal fusion.  Wei Liu, Yongbiao Yang, Qingshan Xu, Yuanxing Xia.  (2023) | Paper proposes a new model for predicting weather-related outages in the distribution system. The authors address the problem of improving the accuracy of weather-related outage prediction. | Authors developed a multi-target prediction model based on spatiotemporal data fusion. The model uses ground subdivision and rainfall waterlogging models to predict the probability of outages. It also uses meteorological, geographic, and power grid data. | The results of the study show that the proposed model is more accurate than other methods. The model was able to improve the accuracy of outage prediction by up to 20%. | Incorporating spatiotemporal data fusion enables the model to capture the dynamic relationships between weather events, geographical features, and power grid conditions, leading to more precise outage predictions | The multi-target fusion and prediction process can be computationally demanding, requiring significant computing resources. | Further research is needed to refine spatiotemporal modeling techniques to capture more nuanced relationships between weather events and outage occurrences in diverse geographical settings. | The proposed multi-target prediction model, leveraging spatiotemporal data fusion and comprehensive data integration, significantly improves the accuracy of weather-related outage prediction, enabling better preparedness and response strategies for utility companies. |
|  | Power Prediction of Combined Cycle Power Plant (CCPP) Using Machine Learning Algorithm-Based Paradigm  Raheel Siddiqui et al.  (November 2021) | Paper analyzes the effectiveness of various machine learning techniques, including Gradient Boosting Regression Trees, K-Nearest Neighbors, Artificial Neural Networks, and Deep Neural Networks, in predicting the power output of combined cycle power plants. | Study employed a dataset containing various operational parameters of a combined cycle power plant, with actual power output values. Dataset was divided into training, validation, and testing sets. Each machine learning algorithm was trained on the training set and evaluated on the validation and testing sets. Performance of each algorithm was measured using metrics such as Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE). | Results demonstrated that GBRT achieved the best performance among the evaluated algorithms, with the lowest MAE and RMSE values on both the validation and testing sets. KNN and ANN exhibited moderate accuracy, while DNN yielded the least accurate predictions. | Evaluating multiple machine learning algorithms provides a broader understanding of their effectiveness in power prediction, employing established metrics like MAE and RMSE allows for objective evaluation of the algorithms' accuracy. | Study focused on static predictions, neglecting the dynamic nature of power generation. optimization of the hyperparameters for each algorithm was not explored, potentially impacting their performance. | Study relied on a single dataset, which may not capture the full complexity of power plant operation across different conditions.  Study did not consider the impact of integrating renewable energy sources on power prediction accuracy. | Study suggests that GBRT is a promising tool for power prediction in combined cycle power plants. However, further research is needed to address the identified gaps in knowledge and ensure the development of robust and adaptable prediction models for complex power systems. |
|  | Prediction of user outage under typhoon disaster based on multi-algorithm Stacking integration.  Hui Hou, Xi Chen, Min Li, Ling Zhu, Yong Huang, Jufang Yu  (October 2021) | Paper addresses the challenge of predicting user outages during typhoons, which can cause significant disruptions to communication and other essential services. | Paper proposes a Stacking integration machine learning model that combines the predictions of multiple base learners, including Random Forest and XGBoost. This approach aims to leverage the strengths of each individual algorithm and achieve more accurate predictions. | Paper reports promising results, demonstrating that the Stacking model can accurately predict user outages during typhoons. The model reportedly outperforms individual base learners in terms of prediction accuracy. | By combining the predictions of multiple algorithms, the Stacking model can potentially achieve higher accuracy than individual learners. | Stacking models can be more complex to implement and interpret compared to individual learners, raining a stacking model can be computationally expensive. | Paper does not provide details about the data used to train and evaluate the model. | Paper presents a promising approach for predicting user outages during typhoons. However, further research is needed to address the identified gaps in knowledge and provide a more comprehensive evaluation of the proposed model's performance and generalizability. |
|  | Application of Geographic Information System for the Installation of Surge Arrestors on over-head 132 k-v Power Line.  Kamran Hafeez, M.A.U Khan.  (2012) | Paper addresses the problem of lightning strikes causing damage to power lines and proposes a solution using GIS technology. | Satellite imagery and GPS data were used to create a digital map of the power line, line profile and tower locations were analyzed and different scenarios for surge arrester placement were simulated. | Digital map showing the location of the power line and towers was created, optimal location for surge arrestors was identified, simulation results showed that the proper placement of surge arrestors can significantly reduce the voltage surges caused by lightning. | GIS provides an accurate way to map and analyze power lines. Satellite imagery and GPS allows for precise location information for towers and other infrastructure and large areas to be covered quickly and easily. | Availability of high-resolution satellite imagery and accurate GPS data can be limited in some areas, costs of acquiring and processing GIS data can be significant. | Simulation results may not reflect real-world conditions perfectly, economic benefits of using GIS for surge arrester installation should be further investigated. | Use of GIS offers a promising approach for improving the reliability and safety of overhead power lines. However, further research is needed to address the limitations of the current methodology and to optimize the benefits of using GIS for surge arrester installation. |
|  | Application of Geographic Information System to Power Distribution System Analysis.  Yusuke Kakumoto, Yuki Koyamatu, Atsushi Shiota, Yaser Qudaih, Yasunori Mitani  (2016) | Paper addresses the problem of calculating photovoltaic (PV) power generation in a distribution system considering the shadow effect of buildings. | Geographic Information System (GIS) is used to create a 3D model of the town and analyze the solar radiation falling on the PV panels, a mathematical model is developed to calculate the PV power generation considering the shadow effect, temperature, and other factors. | Evaluated the state of the distribution system and grasp the PV introduction limit and by monitoring the dynamic behavior and steady state of the distribution system, the method helped in understanding its response to varying PV generation levels. | Method is accurate and takes into account the shadow effect of buildings and can be used to simulate different scenarios and evaluate the impact of PV introduction. | Method requires access to accurate data, such as the height of buildings and the location of trees and can be computationally intensive for large-scale distribution systems. | Further research is needed to develop more accurate models for predicting the effects of weather on PV power generation, long-term performance of PV systems under different environmental conditions needs to be evaluated | Paper introduces a GIS-based method for accurately calculating PV power generation considering shadows, enabling simulation of large-scale PV integration and optimization of distribution systems |
|  | A review on renewable energy and electricity requirement forecasting models for smart grid and buildings  Tanveer Ahmad et al.  (April 2020) | Paper discusses the benefits of renewable energy and reviews different forecasting models that have been used to predict renewable energy generation and electricity demand. | Authors review different forecasting models that have been used to predict renewable energy generation and electricity demand. | Authors find that machine learning, ensemble-based approaches, and artificial neural networks are all promising methods for forecasting renewable energy and electricity demand. | It reviews a variety of different forecasting models. | It does not provide a detailed analysis of any one specific model. | Authors note that there are still some gaps in our knowledge about how to best forecast renewable energy and electricity demand. | Paper provides a valuable overview of the different forecasting models that are available for renewable energy and electricity demand. It is a good starting point for researchers who are interested in learning more about this topic. |
|  | A Comparative Assessment of Conventional and Artificial Neural Networks (ANNs) Methods for Electricity Outage Forecasting.  Adeniyi Kehinde Onaolapo.et al.  (January 2022) | Paper compares conventional and artificial neural networks for electricity outage forecasting. It discusses the importance of reliable electricity supply and the challenges of forecasting outages. | Authors propose two Artificial Neural Network models (ANNs) and compare them to multiple linear regression and expert systems. | **The ANNs outperformed the conventional methods in electricity outage forecasting.** The ANNs achieved a **higher accuracy** in predicting outages, with mean squared error (MSE) values significantly lower than those of multiple linear regression and expert systems. | ANN can learn complex relationships between variables and are not limited to linear relationships, allowing them to capture the complex dynamics of power systems and outage occurrence. | However, it is a black box model, which means that it is difficult to understand how it works and require a large amount of data for training, which may not be readily available in all situations. | Research is needed to develop techniques that improve the interpretability of ANNs, allowing for better understanding of their predictions and decision-making processes. | Overall, this paper shows that artificial neural networks are a promising method for forecasting electricity outages. |
|  | Community power outage prediction modeling for the Eastern United States.  William O. Taylor, Diego Cerrai, David Wanik, Marika Koukoula, Emmanouil N. Anagnostou  (November 2023) | Paper addresses the problem of predicting power outages caused by various weather events, with a focus on improving the accuracy and preparedness for storm-related disruptions. | Paper proposes a machine learning-based approach to predict power outages. ML models are trained on a dataset of historical weather data and power outage occurrences from 17 states in the Eastern US. Models are designed to learn complex relationships between weather variables and outage occurrences, allowing them to predict outages based on incoming weather forecasts. | The trained models demonstrate promising results, achieving an r-squared of 0.61 for predicting outages across various storm types, excluding thunderstorms. This indicates a strong correlation between weather data and predicted outages, suggesting the model's effectiveness in forecasting disruptions. | Ability to learn complex relationships between weather variables and outages. This allows for a more accurate prediction compared to traditional methods that may rely on simpler models or expert systems. | Limited accuracy for predicting outages caused by thunderstorms. This indicates that further research and model development may be needed to improve performance in this specific context. | While achieving high accuracy, the machine learning models lack interpretability, making it difficult to understand the underlying reasoning behind their predictions. Research on explainable AI techniques could help address this issue. | Paper presents a valuable contribution to the field of power outage prediction. The proposed machine learning approach demonstrates promising results and offers a potentially powerful tool for improving storm preparation and reducing the impact of outages on communities. |
|  | Identifying Risk Indicators for Natural Hazard-Related Power Outages as a Component of Risk Assessment: An Analysis Using Power Outage Data from Hurricane Irma.  Sang-Guk Yum, Kiyoung Son, Seunghyun Son, Ji-Myong Kim.  (2020) | Paper addresses the problem of identifying key risk indicators for natural hazard-related power outages, specifically focusing on hurricane-induced outages as a case study. The aim is to provide valuable information for constructing advanced safety guidelines and improving the resilience of power systems in hurricane-prone regions. | Paper utilizes multiple regression analysis to investigate the correlations between natural hazard indicators and power outages caused by Hurricane Irma in Florida. The study focuses on three key variables: maximum wind speed, total rainfall, and tree density, chosen based on a thorough literature review. These variables are analyzed for their individual and combined influence on power outage occurrences. | Analysis reveals significant correlations between all three independent variables (wind speed, rainfall, and tree density) and the dependent variable (power outages). The adjusted coefficient of determination (R-squared) of the model is 0.512, indicating its effectiveness in predicting hurricane-related power outages. Additionally, the results highlight the importance of considering multiple factors, including tree density, alongside traditional wind and rain data for a more comprehensive understanding of outage risks. | The employed multiple regression analysis offers a robust statistical framework for quantifying the relationships between various factors and power outages. This quantitative approach provides objective evidence to support decision-making and risk assessment strategies. Additionally, the focus on hurricane-induced outages serves as a valuable case study for understanding the impact of natural hazards on power systems. | While the model demonstrates good performance, it only considers three independent variables. Further investigation with a wider range of potential factors might improve the model's accuracy and capture a more comprehensive picture of outage risks. Additionally, the study relies on data from a single hurricane event, which may limit its generalizability to other scenarios and geographical locations. | Applying the proposed methodology to other natural hazards, such as earthquakes and floods, could yield valuable insights into broader risk assessment strategies, this isn’t done in this research as well as specific geographical regions would allow for tailored risk assessments and more effective mitigation strategies. | Paper offers a valuable contribution to the field of power systems resilience against natural hazards. The proposed method demonstrates the effectiveness of quantitative analysis in identifying crucial risk indicators for hurricane-related power outages. By addressing the identified gaps in knowledge, future research can further enhance the accuracy and applicability of these risk assessment models, contributing to the development of more resilient and reliable power systems. |
|  | Forecasting Transmission and Distribution System Flexibility Needs for Severe Weather Condition Resilience and Outage Management.  Magda Zafeiropoulou et al.  (July 2022) | Paper addresses the challenge of ensuring flexibility in the transmission and distribution systems (T&D) for improved resilience against severe weather conditions and outage management. It proposes a framework for forecasting the flexibility needs of both systems under various weather scenarios. | Paper uses machine learning techniques, specifically Support Vector Machines (SVM) and Random Forests (RF), to predict wind power generation based on numerical weather prediction (NWP) data and considers individual prosumers and applies a stochastic optimization framework to model their behavior and calculate their flexibility potential. | Both SVM and RF models achieved good accuracy in predicting wind power generation, with average MAPE values of 14.1% and 13.8%, respectively.  The optimization framework successfully estimated the flexibility potential of prosumers, providing valuable insights for managing grid operations. | Machine learning for forecasting wind power generation improves accuracy compared to traditional methods and considering individual prosumers' behavior provides a detailed picture of flexibility potential. | Accuracy of the machine learning models relies on the availability of high-quality NWP data and the bottom-up approach for distribution system flexibility can be computationally expensive for large-scale systems. | Need to explore advanced data fusion techniques to enhance the accuracy of weather forecasts and wind power predictions and incorporate more realistic models of prosumers' behavior to enhance the accuracy of flexibility potential estimations. | Paper presents a valuable contribution to the field of T&D system resilience and flexibility management. By combining machine learning and bottom-up approaches, it offers a promising framework for forecasting flexibility needs, enabling better preparation for severe weather events and improved outage management. |
|  | Risk Assessment and Its Visualization of Power Tower under Typhoon Disaster Based on Machine Learning Algorithms.  Hui Hou et al.  (January 2019) | Paper addresses the problem of predicting the damage probability and risk of power towers under typhoon disasters. | Authors used machine learning algorithms to predict the damage probability and risk of power towers. The data used to train the models included the maximum gust speed, design wind speed, tower height, and ground roughness. | Models were able to predict the damage probability and risk with high accuracy, combined model is superior to the others. | Method can be used to predict the damage of power towers before a typhoon hits. This can help to prevent power outages and other damage. | It requires a large amount of data to train the models. This can be difficult and expensive to obtain. | High-risk grids distributed at the lower left area, where the windspeed is not high, need further investigation and low coverage of relevant monitoring equipment might lead to inaccurate data collection.. | This research could be improved by using a larger dataset and by developing models that are more accurate for different types of typhoons. |
|  | Financial Hazard Prediction Due to Power Outages Associated with Severe Weather-Related Natural Disaster Categories.  Rafal Ali et al.  (December 2022) | Paper addresses the problem of predicting financial losses due to power outages caused by severe weather. | Authors propose a random forest algorithm to predict the revenue loss associated with power outages. | The results show that the random forest algorithm is effective in predicting revenue loss, with Mean Absolute Percentage Error (MAPE) ranging from 23.45% to 38.28%. | It is a non-parametric technique that can handle noise and non-linearity in data. | It requires a large amount of data to train the model. | Gap in knowledge regarding the effectiveness of the method for other types of natural disasters. | The research could be improved by using a larger dataset and by investigating the effectiveness of the method for other types of natural disasters. |
|  | Financial Hazard Assessment for Electricity Suppliers Due to Power Outages: The Revenue Loss Perspective.  Ikramullah Khosa et al.  (June 2022) | Paper addresses the problem of assessing the financial risks associated with power outages for electricity suppliers. | Authors propose a methodology to assess the financial risks associated with outages. The methodology includes identifying the factors that contribute to financial losses, estimating the revenue losses incurred during outages, and developing strategies to mitigate the risks. | Results show that power outages can cause significant financial losses for electricity suppliers. The losses are dependent on the duration and frequency of outages, as well as the number of customers affected. | It is comprehensive and considers all of the relevant factors that contribute to financial losses. | A weakness of the method is that it requires a large amount of data to implement. | There is a gap in knowledge regarding the effectiveness of the method for different types of electricity suppliers and in different geographical regions. | The research could be improved by collecting data from a wider range of electricity suppliers and by conducting a more comprehensive analysis of the factors that contribute to financial losses. |
|  | Dynamic Model for Forecasting Power Outages Caused by Thunderstorms.  Berk A. Alpay et al.  (May 2020) | Paper addresses the problem of forecasting power outages caused by thunderstorms. | Authors propose a new dynamic modeling approach that uses real-time data to forecast power outages. | The LSTM model achieved the best results in predicting power outages caused by thunderstorms. Proposed dynamic modeling approach outperforms traditional event-based models. | Proposed approach uses real-time weather data, which can help to improve the accuracy of the forecasts, LSTM model is a powerful machine learning technique that can learn complex relationships between data. | Approach requires a large amount of data to train the model, LSTM model can be computationally expensive to train. | Effectiveness of the proposed approach for different types of thunderstorms and in different geographical regions needs further investigation, need for more data on the relationship between weather and power outages. | The research could be improved by collecting data from a wider range of thunderstorms and by conducting a more comprehensive analysis of the factors that contribute to power outages. |
|  | The Effect of Lead-Time Weather Forecast Uncertainty on Outage Prediction Modeling.  Feifei Yang et al.  (July 2021) | Paper addresses the problem of improving the accuracy of power outage predictions during weather events. Traditional methods rely on precise weather forecasts, which can be unreliable and lead to inaccurate outage predictions. This research focuses on incorporating the uncertainty associated with lead-time weather forecasts into outage prediction models. | Authors propose a novel outage prediction model that combines:  **Weather Data:** Including precipitation, wind speed, and temperature.  **Historical Data:** To identify patterns and relationships between weather and outages.  **Lead-time weather forecast uncertainty:** Probabilistic measures of the potential variation in the actual weather compared to the forecast.  Model utilizes a Bayesian hierarchical framework to statistically combine the information from these different sources and generate probabilistic predictions of outages. | Study found that incorporating lead-time weather forecast uncertainty into the model significantly improved the accuracy of outage predictions compared to traditional methods:  The model achieved up to 80% accuracy in predicting outages, compared to 60% for traditional methods.  Model provided more accurate predictions for longer lead times, allowing utilities more time to prepare for outages. | Bayesian hierarchical framework allows for a statistically rigorous and flexible approach to incorporating different types of data and uncertainty into the model. | The model requires a large amount of historical data on weather and outages, which may not be readily available for all utilities. | Study focused on predicting outages caused by a single weather phenomenon (hurricanes). Further research is needed to investigate the effectiveness of the model for other types of weather events. | Research demonstrates the potential for incorporating lead-time weather forecast uncertainty into outage prediction models to improve their accuracy and provide valuable insights for utilities to enhance their preparedness and response to weather-related outages. |
|  | Bayesian Optimization and Hierarchical Forecasting of Non-Weather-Related Electric Power Outages.  Olukunle O. Owolabi, Deborah A. Sunter.  (March 2022) | Paper addresses the limitations of current power outage prediction models, which primarily rely on weather data and struggle to predict non-weather-related outages. This research proposes a novel hierarchical Bayesian model that leverages both weather and utility data to improve outage prediction accuracy. | The proposed model combines: hierarchical Bayesian framework and optimization, weather data and utility data containing network topology, equipment performance, and historical outages. | Study demonstratesdthat the proposed model:  achieved a 10% improvement in outage prediction accuracy compared to traditional weather-based models and effectively incorporates utility data, improving its ability to predict outages caused by equipment failures and other non-weather events | The hierarchical framework can be easily extended to incorporate additional data sources in the future. Bayesian optimization algorithm allows the model to continuously learn and adapt to changes in the system and environment. | Bayesian optimization can be computationally expensive, especially for large datasets, model requires a large amount of historical data on weather, outages, and utility operations. | Study primarily focused on a single utility company. Further research is needed to evaluate the model's generalizability to other utilities and different geographical regions, influence of specific types of utility data on prediction accuracy needs further investigation. | This study presents a significant advancement in power outage prediction by demonstrating the effectiveness of combining weather and utility data in a hierarchical Bayesian framework. This approach offers a promising solution for improving utility preparedness, resource allocation, and response to outages, ultimately contributing to a more reliable and resilient power grid. |
|  | Random Forest Regressor-Based Approach for Detecting Fault Location and Duration in Power Systems.  Zakaria El Mrabet et al.  (January 2022) | Paper addresses the challenge of quickly and accurately identifying fault location and duration in power systems. This is important because it can minimize service interruption times and improve system reliability. | Authors propose a novel approach that utilizes a random forest regressor to predict fault location and duration based on real-time data. This method leverages the power of machine learning to analyze complex data patterns and make accurate predictions. | The proposed approach was tested on a simulated power system and achieved an accuracy of 95% in identifying fault location and duration. This is significantly higher than the accuracy of existing fault detection methods | Approach can be readily scaled to accommodate larger and more complex power systems, random forest regressor demonstrated excellent performance in identifying fault timing,  making it a reliable tool for real-world applications. | Study only evaluated the method on a simulated power system. Real-world performance may vary depending on specific system configurations and operational conditions. | Paper does not discuss how the proposed method handles situations with limited or noisy data. | Proposed random forest regressor-based approach presents a promising solution for improving fault detection and isolation in power systems. Its high accuracy, fast processing, and scalability make it a valuable tool for enhancing system reliability and reducing service interruptions |