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Review Paper

Protection of transmission line and distribution system by using support vector machine: a Review

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Abstract

In this article, an overview of the protection of transmission lines and distribution system is given with the help of a support vector machine. The errors of investigation and their causes have an essential basis for a secure and consistent power supply always. Rapid changes in the supply system due to disturbances, grid changes due to line trip, and break a large load or generating unit, force the rest to steer and solve new stable conditions. Necessary measures must be taken to protect the transmission and distribution system, such as error detection, classification and localization of errors. In the transmission and distribution system, fault classification mainly adopted well-developed by applying the use of algorithms of machine learning such as, for example, artificial neural networks, fuzzy logic and support vector machines.

Keywords: Artificial Neural Network, Fuzzy Logic, Support Vector Machine.

Introduction

Exposures are parts of the electrical power supply, in the fault probabilities are usually higher than those of other system components. Guiding errors due to natural catastrophes such as lightning, storm etc. are the out of control of man. To ground the balanced transmission line of faults in a three-phase shunt faults and three phase faults. Some phase-to-earth errors, line-to-line errors and double-line-to-earth errors make its imbalance. On a transmission line the safety scheme is combined to detect the unwanted signals which represent errors and separate the fraction from the rest of the system with rated faults and damage to the device. One of the most important objectives of the security system is to detect errors on transmission lines as quickly as possible. Another important task is to locate exactly the error point. Therefore, it is very important to detect these errors on transmission lines fast and reliable methods of location, reduce the time, the necessary service to continue the consumers.

An accurate and fast speed of faults on high-voltage cables is crucial for the stability of the complex and the modern energy system. This requires a lot of work to do to develop the performance of digital protective relays. The use of brilliant techniques to investigate faults and safety systems played an important role in improving the reliability of the power grid. Distance protection method is automatically used by the high rate of free space for the protection of high and ultra-high voltage power transmission or sub-transmission lines. Relays are devices that turn off the circuit breaker when faults, the inputs for these devices, voltage, current, temperature or frequency. The protective relays detect these inputs and compare them with set points, and transmit signals to the circuit breakers.

Recently, researchers found the power and consistency of the transmission line to be improved by connecting the power electronics controllers to the transmission. These electrical devices or FACTS (Flexible Alternating Current Transmission System) to support the transfer of the capacity increase, healthier current flow control and improved voltage stability and control. The fact that devices interfere with the distance protection in the event of failure or transition conditions because they are based on the voltage and current response to the relay. Therefore, it is important to examine the performance existing protective relays FACTS lines compensated transmission.

ANN basic method requires a lot of training and test for the implementation relay, so it takes a lot of time on the training and can suffer from several local minima. The correct classification and characteristics of the Collecting Support Vector Machine (SVM) are used as a pattern class. Modified apparent impedance parameters or measurement voltage or current limits are calculated for training patterns given to the optimal SVM. In this summary summarized details of some documents on the development of error diagnostic procedures based on techniques for the support vector machine (SVM) and applications of SVMs to distance relaying.

Summarized Review

An innovative approach for the zone identification of the mho relay is introduced on the transmission line by means of the thyristor-controlled series capacitor (TCSC). The existence of a number of System FACTS (Flexible Alternating Current Transmission System) can significantly interfere with the operation of the safety system and can lead to safety and reliability problems. The proposed method is dependent on the modified apparent impedance by the impedance relays is visible for all existing operating conditions. This method was used to select the Support Vector Machine (SVM) defective zones (Zone 1 or Zone 2). Beside this other optimization technique, namely, Genetic Algorithm (GA) used to optimize SVM parameters. To apply, the above procedure was made a typical 220 kV system PSCAD / EMTP / MATLAB software and the results displayed to simulate that the proposed method was sure to be accurate and consistent among the large differences in parameters of power systems such as load angle, Fault resistance, starting angle and height of the compensation[1].

P.K. Dash, et al. proposed to use a new approach for the classification and marking of a sophisticated transfer of plywood series of SVM (Support Vector Machine) errors. (CTSC), static synchronous compensator and reactive power compensator has a very demanding task. This article presents a new approach to the security of TCSC line of a support vector machine (SVM). The proposed method provides the samples of leakage current for the six months (ten samples) from the beginning of the disturbance and the corners of the bicycle as all the SVM inputs. Three SVMs are formed to provide the classification of errors, the detection of the ground, and the identification portion of the line using TCSC. The SVMs are designed to obtain kernel polynomial and Gaussian kernels with different values the best optimized class. The proposed method quickly achieves results with a smaller number of training samples with respect to the neural network and neuro fuzzy system, the speed and accuracy of the proposed technique with TCSC show the protection of the transmission line[2].

B. Ravikumar et al. investigated the procedures for the use of Multiclass Support Vector Machines (SVM) for effective regulation of remote distance. He also described the conventional protection philosophy a strategy of security (system performance) in conflicting situations where security systems did not work properly to support and / or lack facts and provide a secure and selective coordination. SVM have a considerable potential as zone classify distance coordination. This usually requires a multi-class SVM classification to investigate the basic concept in the area between different zones and the apparent impedance profile during the error. There have been proposed different procedures for multi-class classification, usually numerous binary SVM canten are combined. Some authors have expanded binary SVM classification to a one-step operation optimization, all classes taking into account simultaneously. In this document, classification stage multi-class, a one-to-all, and a one-to-one multi-class method for their performance in terms of accuracy, the number of iterations, the number of support Training, and test time. The results of these three methods were presented in three data sets, which were presented to training and test patterns of three power systems for a region and part of a network that had an equivalent 526 bus system of the practical Western Indian network[3].

Agrawal and Thukaram introduce a approach for detecting the broken line segment and the location of it on the transmission line using Support Vector Machines (SVM) for a diagnosis / error analysis heading. The analysis of the errors of the last large current errors around the world, that malfunctions and / or improper coordination of the security at a certain level were responsible. Prevent cascade vibration by a fault, and scolded the circuit breaker in zone 1 is broken by improper discrimination broken off. When this occurs, the safety and control measures must be necessary to protect the energy system and restore the system to a normal condition and to reduce the effects of disturbances. It seems that the need to improve the system of protection through additional posting errors and remedial studies using intelligent techniques. A technique of obtaining knowledge based on SVM has been proposed here for error analysis purpose. The proposed approach can help to improve the fault analysis process to ensure the safe operation of power plants. To apply the proposed approach, a practical 24-bus equivalent EHV transmission system from the South Indian region was proposed to show the improved generalization with the large travel classifier to improve the efficiency of the practical model[4].

Seethalekshmi K. et al. introduces a new approach to prevent remote relay. The times and working under the support vector machines oscillation and voltage stabilization. Resistance relay in power transmission systems is subject to malfunction under certain operating system events such as voltage surges and instability, motion to fictitious impedance paths in the Relay protection. The fast and reliable identification of symmetrical defects, errors that occur during voltage fluctuations, is another activity, which is for the operation of the distance relay. The proposed method is distinguished in failures of the system of event flows, voltage fluctuations and voltage instability. This article also presents a new relay classification index called the relay classification model, which is more sensitive to growth and voltage instability for mold functioning. The SVM Canten proposal classification can cooperate with the classical remote reference unit. The implementation of the proposed project was tested on a New England bus system WSCC of the bus system 09:39[5].

Jafarian and Pasand present a new safety based on the frequency transient generated by the fault technique that covers almost the total length of the multipole transmission lines from the SVM technique. The protection of multi-terminal transmission lines was a difficult task due to possible flows of incoming or outgoing different lines of taps. Consequently, the first zone is non-communication-based systems (e.g. intervals of impedance-based intervals) is typically no more than a small part on the outside of the cutting point. In this article, the high-frequency transient is a new safety technology of non-communication for the multi-terminal transmission lines generated by the error. To reduce the influence of the parameters of the relay power variable power supply systems and the conditions are a well-established line with the fluorescence terminals installed. The dyadic wavelet transform (DWT) is used to analyze the interference signals in different frequency bands. Subsequently, the spectral energy of the signal in each frequency band was calculated. The motor support vector (SVM) is used to classify the errors into two groups of inner and outer defects according to their frequency spectrum. The simulation studies are conducted with the simulation software PSCAD / EMTDC / MATLAB to calculate the proposed algorithm performance in different environments[6].

Karthik Thirumala et al. have proposed a new automatic recognition methodology created on a wavelet-transformable-Q (TQWT) and a double multi-class vector support (MSVM) for the on-line detection of power failures. The approach suggested to first investigate the occurrence of inter-low-frequency harmonics and then uses the signal distributed into main components and harmonics. The orientation of the Q-factor is performed so as to be only the filter design for extracting the necessary frequency element of a distorted input signal. So there is a exclusive set of functions that clearly misrepresent the error features. The quality interference errors are largely characterized by two groups, based on data acquired previously from the low frequency telephone input. Therefore, a number of errors, recognized by the use of a double-stranded MSVM, are one for each group. The outcomes determine the applicability, the strength and the accuracy of the approach proposed for the grouping of the individual and joint in different critical error conditions. In addition to explaining the importance of TQWT functions, two classifier decision-tree-based and pre-neural networks are used to classify network quality problems[7].

Singh and Chopra focused on detection, classification and interference to localize electrical transmission lines. Error detection and classification using support vector machines. The SVM-based classifier is trained to classify transient single-phase ground faults on the database error. There are simulation results provided that show machine-based support vector methods to be effective in locating errors in transmission lines and eighteen performances. Simulation of three-phase transmission line was performed in MATLAB and the results are compared in the context of error classification and fault location[8].

Khaled Abduesslam-M et al. introduces a classification of the voltage problem with support vector machine (SVM) of the power system using the Least Square support vector machine input (LS-SVM) based algorithm, and operating on the IEEE-39 bus New England system. The results were collected from the time domain simulation by using inputs in the LS-SVM classification and LS-SVM PTSI (Current Line Stability Index) estimate on the minimum square-rate support vector engine used as a predictor to calculate the dynamic voltage- Indexes to determine by increasing the power in the load buses. The core function type and kernel parameters to consider. To verify the effectiveness of the proposed LS-SVM classification and estimation methods, its performance was compared to the LVQ. The results show that both the LS-SVM classification and the estimate is faster and better with 100% compared to 61% to 538 LVQ, which has a misclassification[9].

N. Shahid et al. provides two innovative methods for detecting and classifying errors in transmission lines (TL). Smart networks have recently attracted the attention of many in more in-depth investigations with their ability to design automated and distributed energy. Computational Intelligence (CI) has been an important topic in various functions of Smart Grids, including the detection and classification of errors in all energy systems. The proposed approaches are based on a class support quadratic machine (QSSVM). The first technique, the temporal attribute QSSVM (TAQSSVM) manages the temporary attribute and data in TL-measured correlations for detecting errors in the transition phase. The second technique, based on a new formulation of an SVM class known as the attribute QSSVM (A QSSVM) attribute correlate uses only the automatic classification of errors. The results show an accuracy of detection and classification of up to 99%. A significant reduction in the complexity of the computer has been achieved using the most advanced techniques to use a variety of classes for the classification of SVM errors. In addition to advanced techniques, the two techniques are unattended and online and can be used in existing monitoring infrastructure for monitoring, detection, and online classification[10].

Samantaray and Dash has proposed a high-impedance intelligent detection technique (HIF) using an advanced Kalman Filter (EKF) and a Support Vector Machine (SVM). The proposed approach uses the amplitude and the phase change of fundamental importance, the harmonic components 3, 5, 7, 11 and 13 as inputs to, SVM function. The Gaussian base has been formed with the input signals, each of which is 12, with associated functions of target vector, 1 'for HIF detection, and, -1' for HIF it was not. The size and the phase change are estimated by EKF. The proposed approach has been trained with 300 data sets and has been tested for 200 data sets, including significant differences in business results and exceptional situations in harsh environments. Therefore, the proposed method was shown to be fast, precise and robust for the detection of HIF distribution in the feed[11].

Sun and Zha have presented a fault diagnosis system for a key component of the separators in electrical circuits of the track with different support vector machine strategy with one-on-to-one. First of all, an electrical circuit model is developed based on the transmission line. A signal was obtained, the short-circuit signal, and the effects on it are then examined for the presence of a disconnection of faulty electrical connections. The current signal consists of a curved segment and the segment can be approximated by a square polynomial. The coefficients of the polynomials for the first three accurate segments are used as error characteristics to form the support vector engine. The training parameters are selected using cross-validation techniques. Polynomial and RBF Gaussian are key functions in use. The experimental results with simulated data show that the exact number of diagnosis can be achieved, more than 96% using this method, which meets the requirements of practical application[12].

A series of complete index evaluation systems were evaluated for the selection of the position of the transmission and transformation station, produced on the basis of the Baotou Hohhot state of the project and the Transfer of the treatment station. It is used for the purposes of the aforementioned evaluation of the Analytic Hierarchy Process (AHP) to determine the difference in the weight index evaluation and the vector classification vector technique, a complete evaluation of the Project location of the transfer station and transformation was introduced by many problems the comprehensive evaluation involved of power transmission project. Empirical research and comprehensive evaluation of the transmission of the project post and the transformation of Baotou to Hohhot were produced accordingly, so that the scoring system was improved. This proposed approach also increases the efficiency and reliability of energy distribution in western Inner Mongolia[13].

Malathi and Marimuthu and presented a new approach in combination with wavelet transformation and support vector engine (SVM) based algorithm for estimating the error in transmission lines. The discrete wavelet (DWT) transformation has been used for data processing, and processed data is used to train and test the SVM. Five types of wavelet for signal processing to be used to identify a suitable wavelet family that was more applicable to estimate the error location. The conviction of the ability of the SVM to recognize the situation from the patterns provided for this purpose, and to accurately estimate the localization of errors with different noise immunity[14].

Kuan-Ming Lin and Chih-Jen Lin before reduced support console aninnovativa methodology (RSVM), as an alternative to standard SVM. Encouraged by solving the difficulty of processing large amounts of data used by the non-linear SVM kernel, selects a subset of data as carrier for the carrier and solves a low optimization problem. We also want to see how the big problems of RSVM equilibrium as in SVM training time. The new approach shows that RSVM formulations were already in the form of linear SVM and discussed four RSVM implementations. The results show that the RSVM test accuracy is generally somewhat smaller than that of the SVM standard. In addition, problems up to tens of thousands of data as a percentage of support vectors are not high; the existing implementations of SVM on training time have been sufficiently competitive. With many support vectors of this empirical RSVM study will be particularly useful for larger ones or problems[15].

Smola and Scholkop reported summary of the basic concepts of Support Vector (SV) machine function estimation. It contains a summary of the currently used algorithms for machine training SV, which include both the square (or convex) part programming and advanced methods for handling large amounts of data. Finally mentioned some changes and extensions are applied with the standard SV algorithm, and discusses the aspect of customization from an SV perspective[16].

James Tin-Yau Kwok has proposed the use of modest to embodiments to make the support vector machine (SVM) by using a relationship between the SVM and the proof job. The modernized edition was more consistent with the Bayesian idea, which should be taken into account when the back weight predicts, and it also reduces the usual tendency to grant highly reliability to the estimated class affinity of the test patterns. Moreover, the moderated output can be derived here as an approximation of the underlying class likelihood. It can be so sensible rejection thresholds and outputs can be assigned directly from a variety of networks can be directly compared. SVM was based on the idea of the structure risk minimization (SRM), which shows that the generalization error is defined by the sum of the exercise setting error and a runtime depending on the dimension of the Vapnik-Chervonenki of the learning machine. The results also discuss both the real and the real world data[17].

Chih-wei Hsu et al. proposed the SVM (Support Vector Machines) technology for data classification was introduced. Although SVM results in better results than Neural Networks, users who are unfamiliar with this, at first glance results in unsatisfactory results. A classification task usually involves separating data into training and test sets. Each event in the training set includes a "target value" (that is, the class tags), and a number of "attributes" (i.e., the properties or observed variables). The goal of the SVM was to create a model (based on the training data) that predict the target values of the test data, only show the test data attributes[18].

Campbell and Ying gave an introductory overview of a support vector machine to perform binary classification before multi class classification and the main types of cores used in practice and how to consider you can predict and predict various types of input data. Support vector machines have been an established learning tool in the machine. Training involves optimizing a concave function of a Support Vector Machine (SVM) a unique solution. The data are stored in the form of cores, which quantify the similarity or difference of data objects. Nuclei can now be constructed for a variety of data objects of continuous and discrete input data, by means of the sequence and graph data. This and the fact that many types of data are processed within the same model, the approach is very flexible and powerful. The kernel substitution concept is based on many other methods for data analysis. Thus, SVM is the most familiar of a wide class of methods that use cores to represent data and call core-based methods[19].

Jason Weston gave an introductory idea to solve the problems of classification and regression with SVM. For SVM classification problems try to find a state plan to separate data points according to their classes so that the separation between the classes was maximum. In this case, the status of the plan will be the optimal state of the plan. However, the practical classification problems should be separated non-linearly in actual scenarios. To meet this scenario, a non-linear version of SVM is developed in the literature by transforming the transformation of the training data into a multi-dimensional space thanks to the nonlinear transformation of this nonlinear transformation. The non-separable original data can be separated in an extended space[20].

Conclusion

A verification of the security of the transmission and distribution is made by using support vector machine with this product. Because the implementation of digital broadcasting is carried out for the realization of digital protection relays, but necessary in the framework of the reform of the energy industry and the operation of transmission lines near the limits of Stability are new tools and algorithms to improve reliability and maintain security to an acceptable level system, SVM has the best results on different fault diagnosis applications because it is based on pattern recognition algorithms.

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