Power Transformer Protection: Use of Artificial Intelligence View One

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Abstract:

This paper gives a rough idea about the use of artificial neural network to the protection of power transformer. The protective system include devices that recognizes the existence of a fault, indicates its location and class, detect some other abnormal fault like operating condition and start the nascent steps of opening of circuit breaker to disconnect the faulty equipment of power system. The ANNs in these existing studies are specific to particular transformer systems, and would need to be retrained again for other systems. In case of incipient fault protection using Dissolved Gas Analysis (DGA), initially a single Artificial Neural Network (ANN) with three layer architecture is developed that have the best performance for individual fault diagnosis. But, when a single ANN is used for individual fault diagnosis, the accuracy and training speed are low. Also sometimes data availability may be insufficient and inconsistent for ANN training. Therefore, a combined ANN and Expert System (ANNEPS) tool is developed for power transformer incipient fault diagnosis.

Keywords: Expert System, Fuzzy, Neural, Transmission Line, DGA

I.   INTRODUCTION :

Commonly, AI is understood to be the intelligence exhibited by machines and software, for instance, robots and computer programs. The term is usually wont to the project of developing systems equipped with the intellectual processes features and characteristics of humans, just like the ability to think, reason, find the meaning, generalize, distinguish, learn from past experience or rectify their mistakes. In power system operation and control the basic goal is to provide users with quality electricity power in economic rational degree for power system, and ensure their stability and reliability. So it is necessary to carry out the planning of power system monitoring and control, but with the development of the electric power system, the demand is coming more and more, in order to ensure its safety, economic and reliable operation of the workload increase, it also has been increased

the burden of staff operation. The computer software of the existing EMS center is usually the numerical analysis software, it is difficult to have the target processing in operation of the power system[1], especially in the fault condition. An electric power grid could even be a network of electrical components wont to supply, transmit and use electrical power. Power system engineering deals with the generation, transmission, distribution and utilization of electrical power and other electrical devices.

II.   ARTIFICIAL INTELLIGENCE TECHNIQUES

Three major families of AI techniques are considered to be applied in modern power system protection

•   Expert System Techniques (XPSs),

•   Artificial Neural Networks (ANNs),

•   Fuzzy logic systems (FL).

Expert system

Expert system in artificial intelligence, an expert system could also be a computer system that emulates the decision-making ability of an individual's expert. Expert systems are designed to unravel complex problems by reasoning through bodies of knowledge, represented mainly as if–then rules rather than through conventional procedural code[3]. The first expert systems were created within, the 1970s then proliferated within the 1980s.
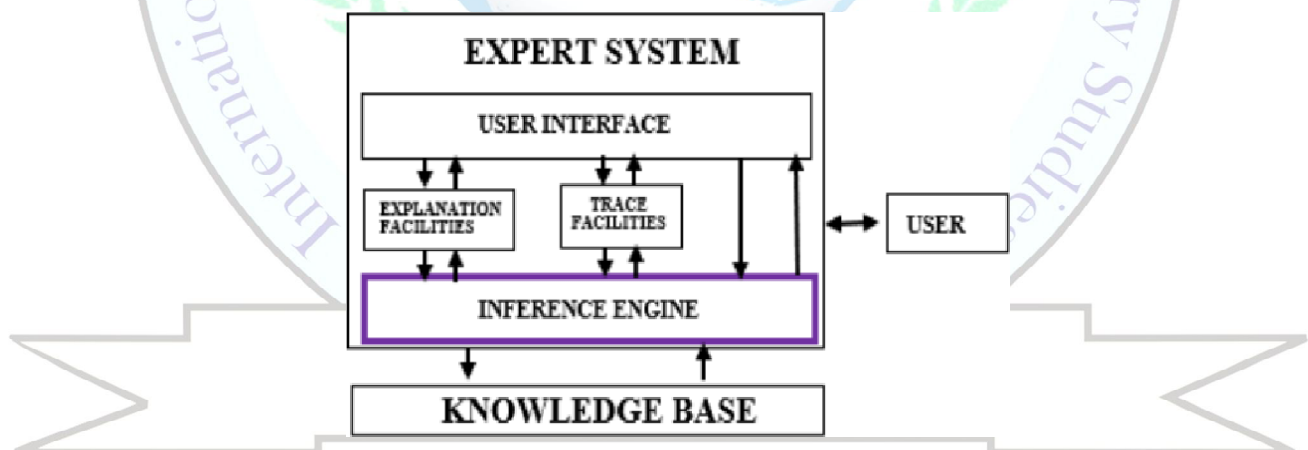

Expert system architecture

Expert system architecture Expert system architecture Expert systems were among the primary truly successful sorts of AI (AI) software. An expert system is split into two subsystems: the inference engine and therefore the knowledge domain. The knowledge base represents facts and rules. The inference engine applies the principles to the known facts to deduce new facts. Inference engines also can include explanation and debugging abilities. The limitations of the previous sort of

expert systems have urged researchers to develop new sorts of approaches. They have developed more efficient, flexible and powerful approaches so as to emulate the human decision-making process. Some of the approaches that researchers have developed are based on new methods of artificial intelligence (AI), and in particular in machine learning and data mining approaches with a feedback mechanism. Related is the discussion on the disadvantages section.

Artificial Neural Network

Artificial Neural Network Artificial neural network are biologically inspired systems which convert a set of inputs into a set of outputs by a network of neurons, where each neuron produces one output as a function of input. The artificial neural network(ANN) Artificial neural network (ANN) is from the perspective of simulated neurons process information using nonlinear mapping method of brain information processing, storage and search mechanism and combining it with AI mechanism.

Through connections in a number of simple elements and samples to learn, getting the right results and resolve the complex equations and nonlinear problems brought by the difficulties[4].
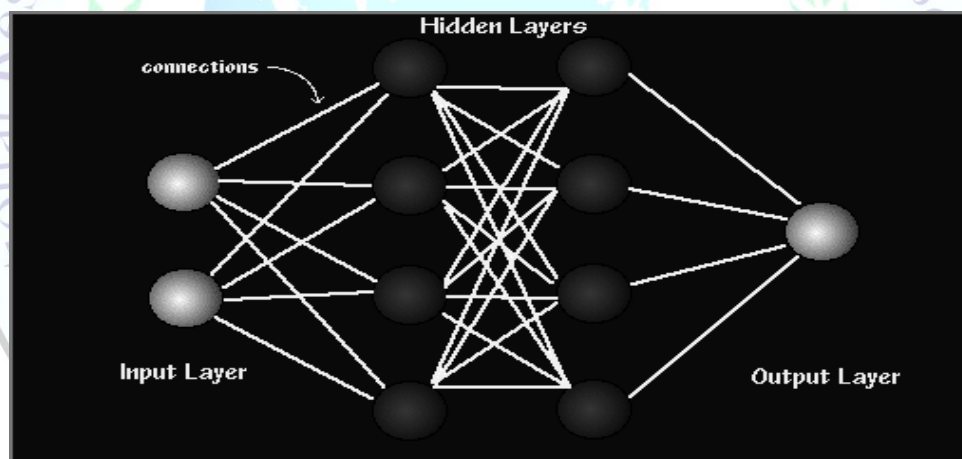

ANN Structure

2.3   Fuzzy Logic

Fuzzy common sense is that the way throughout human mind works, and they can use this era in machines so as they will carry out incredibly like humans. It provides expressive strength and better functionality to model complicated problems. Fuzzy ideas and mathematical fashions for dealing with the sensible concept is not clear or obscure statistics such as: immoderate current , an excessive amount which membership does not allow to clean[6].Fuzzy recognition theory is especially used inside the safety of the primary transformer safety, line safety and discovery and protection , and so on . Because the fuzzy systems will not determine the problem is not inside the pattern of accuracy and will not be uncertain elements on the strict matching [7],so as correctly for

about to a certain context, the fault tolerance of expert system is increased.
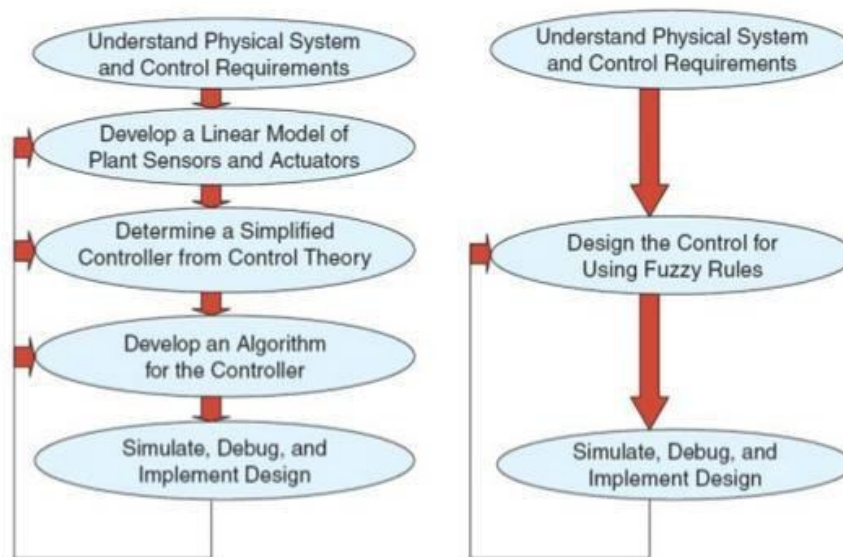
Fuzzy logic Architecture

How expert systems can be used in power systems:

- Since expert system are essentially laptop programs, the procedure writing codes for these applications is simpler than in reality calculating and estimating the price of parameters used in generation , transmission and distribution[8].

- Any changes even after design may be effortlessly finished because they may be pc programs.

- Virtually, estimation of these values are frequently achieved and further research for increasing the efficiency of the method are often also performed.

How ANNs can be used in power systems:

- As ANNs perform organic instincts and perform organic assessments of global problems [9], the troubles in generation, Transmission and distribution of strength may be fed to the ANNs so that a suitable solution may be obtained.

- Given the limitations of a realistic transmission and distribution System with the proper values of parameters are often determined.

How fuzzy logic can be used in power systems:

- They will be utilized in anything from small circuits to large mainframes.

  They will be wont to increase the efficiency of the components utilized in power systems.

4.   PRACTICAL APPLICATION OF AI

Systems in Power System Protection

Feature	XPS	ANN	FL
Knowledge base	Expert knowledge in the form of rules objects & frames etc.	Information extracted from the training set.	Expert knowledge in the form of protection criteria.
Troubleshooting	Changes of rules required	Internal signals are almost difficult to interpret.	Internal signals are almost understandable and easy to interpret.
Self-Learning	possible	natural	Possible
Handling unclear cases	Possible	Natural	Natural
Robustness	Non-Critical and easy to ensure	Difficult to ensure	Non-Critical and easy to ensure
Computations	Expensive	Dedicated Hardware	Moderate

4.2   Current Application of AI

Systems in Power System

(i)   Planning of power system like generation expansion planning, power grid reliability, transmission expansion planning, reactive power planning.

(ii)   Control of power grid like voltage control, stability control, power flow control, load frequency control.

(iii)   Control of power stations like cell power plant control, thermal power station control.

(iv)   Control of network like location, sizing and control of FACTS devices.

(v)   Electricity markets like strategies for bidding, analysis of electricity markets.

(vi)   Automation of power grid like restoration, management, fault diagnosis, network security.

V.   CONCLUSION:

The most feature of power grid design and planning is reliability. Conventional techniques don't fulfil the probabilistic essence of power systems. This leads to increase in operating and maintenance costs. Plenty of research is performed to utilize the present interest on AI for power grid applications.

Tons of research is yet to be performed to perceive full advantages of this upcoming technology for improving the efficiency of electricity market investment and particularly power systems which use renewable energy resources for operation.

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