Artificial Intelligence in Power Station

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Abstract: Artificial intelligence is the science of automating intelligent behaviours currently achievable by humans. Power system has grown tremendously over a few decades. As the size and complexity of the power system consisting of generators, transmission lines, power transformers, distribution transformers etc. increases the possibility of inviting faults. The acquisition of data, the processing of those data for use by the operator, and control of remote devices are the fundamental building blocks of all modern utility control systems. Manual calculations, technical analysis and conclusions initially adopted the power system design, operation and control. As the power system grew it become more complex due to the technical advancements, variety and dynamic requirements.

Keywords: Artificial intelligence, Expert system, Artificial neural network, Fuzzy logic, Power station.

I. INTRODUCTION

There are three types of major power plants known for the massive electricity generation :
i) Thermal power plants, ii) Hydal power plants, iii) Nuclear power plants.

One may expect that the mobile sensing will play an increasingly important role in the monitoring of power system. Artificial intelligence is known to be the intelligence exhibited by machines and software, for example, robots and computer programs.

An expert system obtains the knowledge of a human expert in a narrow specified domain into a machine implementable form. Expert systems are unable to learn or adopt to new problems or situations. Expert systems are also called as knowledge based systems or rule based systems. Expert systems are computer programs which have proficiency and competence in a particular field.

Artificial neural networks 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 inputs. A fundamental neuron can be considered as a processor which makes a simple non linear operation of it's inputs producing a single output. They are classified by their architecture : number of layers and topology : connectivity pattern, feed forward or recurrent.
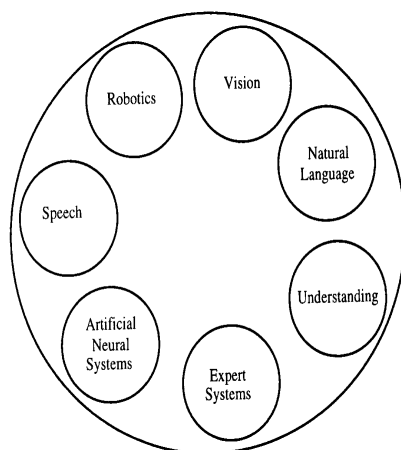
Advantages of artificial neural networks :
- Speed of processing.
- They do not need any appropriate knowledge of the system model.
- They have the ability to handle situations of incomplete data and information, corrupt data.
- They are fault tolerant.
- Artificial neural networks are fast and robust.

Disadvantages of artificial neural networks :
- Large dimensionality.
- Results are always generated even if the input data are unreasonable.
- They are not scalable i.e. once an artificial neural network is trained to do certain task, it is difficult to extend for other tasks without retraining the neural network.

Fuzzy logic or fuzzy systems are logical systems for standardisation and formalisation of approximate reasoning. It is similar to human decision making with an ability to produce exact and accurate solutions from certain or even approximate information and data. Fuzzy logic is the way like which human brain works, and we can use this technology in machines so that they can perform somewhat like humans.

II. METHODOLOGY

There are mainly three techniques : i)Expert system techniques, ii)Artificial neural networks, iii)Fuzzy logic systems.

➢ Since expert systems are basically computer programs, the process of writing codes for these programs is simpler than actually calculating and estimating the value of parameters used in generation, transmission and distribution.

➢ Any modifications even after design can be easily done because they are computer programs.

➢

➢ As artificial neural networks operate on biological institutes and perform biological evaluation of real world problems, the problems in generation, transmission and distribution of electricity can be fed to the artificial neural networks so that a suitable solution can be obtained.

Fig. 1 : Artificial neural system

➢ Given the constraints of a practical transmission and distribution system, the exact values of parameters can be determined.

➢ For example, the value of inductance, capacitance and resistance in a transmission line can be numerically calculated by artificial neural networks taking in various factors like environmental factors, unbalancing conditions, and other possible problems.

➢ Fuzzy logic can be used for designing the physical components of power systems.

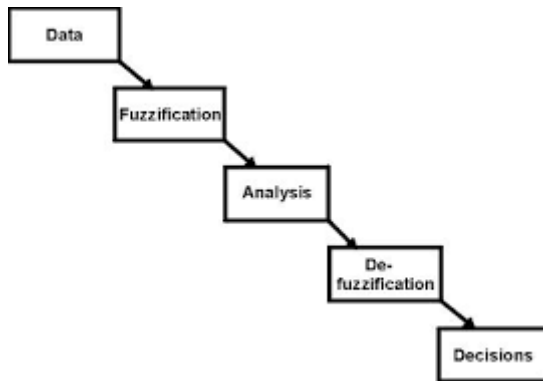Fig. 2 : Fuzzification

III. RESULT

- Replacing human workers for dangerous and highly specialized operations, such as live maintenance of high voltage transmission lines, has been a long standing effect in the power community.
- Operation in hazardous environments, such as radioactive locations in nuclear plants, access to tight spaces, such as cable viaducts and cooling pipes, and precise positioning of measurement equipment.
- Expert systems use the interface mechanism and knowledge to solve problems which cannot be or difficult to be solved by human skill and intellect.
- Results are permanent and consistent.
- Can be easily documented.
- Results can be easily transferred and reproduced.
- The understanding of the working of neurons and the pattern of their interconnection can be used to construct computers for solving real world problems of classification of patterns and pattern recognition.
- Fuzzification provides superior expressive power, higher generality and an improved capability to model complex problems at low or moderate solution cost.
- Stability analysis and enhancement.
- Power system control.
- Fault diagnosis.
- Load forecasting.
- Reactive power planning and its control.
- Operation of power system like unit commitment, hydro-thermal coordination, economic dispatch, congestion management, maintenance scheduling, state estimation, load and power flow.
- Planning of power system like generation expansion planning, power system reliability, transmission expansion planning, reactive power planning.

- Control of power system like voltage control, stability control, power flow control, load frequency control.
- Control of power plants like fuel cells power plant control, thermal power plant control.
- Automation of power system like restoration, management, fault diagnosis, network security.
- Can be used in anything from small circuits to large mainframes.
- Can be used to increase the efficiency of the components used in power systems.
- As most of the data used in power system analysis are approximate values and assumptions, fuzzy logic can be of great use to derive a stable, exact and ambiguity free output.

IV. CONCLUSION

A reliable, continuous supply of electrical energy is essential for the functioning of today's modern complex and advanced society. Electricity is one of the prime factors for the growth and determines the value of the society. So, implementation of artificial intelligence is very important in power system.

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