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A Novel Analysis of Artificial Intelligence in Mechanical Engineering Application

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Abstract

In this study, we have tried to explain the crucial role of Artificial Intelligence (AI) in the running of mechanical industry. The technology used these days in the machines is to aid the solution towards the real-world problems and complex situations. Many AI algorithms have been able to provide the solution to many engineering approaches. The importance of the artificial intelligence has automatized the mechanical engineering with smart machines and robots. Algorithms including computation systems, fuzzy logic systems, and neural networks have grown to solve the problems in engineering. Artificial intelligence has laid a good impact over these years in the engineering industry and has evolved smart systems that are a great aid to the human life and has also widened the horizons for the researchers with respect to future.

Keywords: *Artificial intelligence, mechanical, complex algorithms, smart systems, Fuzzy logic, neural networks, boundary element method (BEM), method of fundamental solutions (MFS)*

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INTRODUCTION

The aim of artificial intelligence (AI) is to discover mechanisms of adaptation in a changing environment with utilization of intelligence, for instance in the ability to exclude unlikely solutions [1]. Artificial intelligence methods have extensive application in different fields such as medicine, games, transportation, and heavy industry. This study deals with interdisciplinary issues—interconnection of artificial intelligence and finance. The study briefly describes techniques of data mining, expert systems, and agent-based computation intelligence and specifies the types of tasks solved by these techniques in the context of financial tasks. It provides deeper insight into potential usage of intelligent systems on financial markets [2, 3].

Vision may be done much more efficiently and success as possible on the basis of sensory inputs, avoiding the fully when the system knows what it is looking for computational and semantic difficulties of large databases the essence of a computer vision subfield called model-based vision. The agent has such a system, allowing it to remember more about the con-a continuing interaction with the world; it can utilize prior text of its action while retaining much of its computational knowledge to predict what it will see. Manipulation research has addressed such problems as planning the motion of arms through space and computing appropriate angles from which a manipulator should grasp an object [5, 6].

BASIC CONCEPT OF ARTIFICIAL INTELLIGENCE

The second observation is that computer-aided design (CAD) tools, as powerful as they are for the later stages of design, are still poorly adapted to preserving the ambiguity inherent in the preliminary phases of the design processes. As summarized in Section 2 of this study, for the last 30 years researchers in engineering and product design, computer graphics, psychology, and user experience (UX) have generated in-depth theories, prototype tools, and methods to address these issues. In the domain of sketching design tools, a large number of researchers are active in sketch-based interface for modeling [8].

These assumptions, even if they are often intuitively accurate, are not always grounded by analysis of designers' observed processes and needs. In contrast, communities of psychologists, ergonomists and UX theorists have proposed models, designs, methods and guidelines that are based on observations of the real behaviours of designers, but these have only slowly aimed adoption in everyday work practice, in part because such models may sometimes be too general or too difficult to realize from the point of view of software development [12, 13].

VARIOUS APPLICATIONS OF AI IN MECHANICAL ENGINEERING

The deduction of mechanical properties from experimental knowledge is basically AN inverse analysis wherever the info is compared to the predictions of a model by modifying the input parameters for the model till a satisfactory match is earned. Typically, times, this is often done manually via trial-and-error. Mechanical behavior of composite materials depends on the unmoved mechanical response of the constituent phases [9]. Materials inside a composite body typically behave otherwise than their monolithic forms and a whole understanding of the unmoved mechanical behavior of every phase is important so as to model the mechanical behavior of the material [14-17].

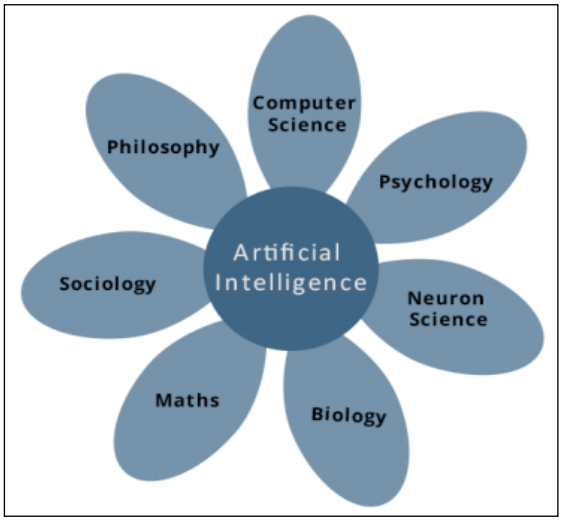

Fig. 1: *Block Diagram of AI in Various Applications.*

Artificial neural networks were oft used within the modeling of the constitutional behavior of monolithic and composite materials typically besides finite part modeling. It follows from the sooner discussion that for a haul wherever we have a sufficient range of values sets for input and output variables, we are able to develop a neural network, which might be then used to predict the unknown output values for a few different input sets. These options of ANN may be used to the good thing about mechanical engineers within the application areas like internal control [18].

Production coming up with, job search planning, supply/demand statement, mechanism style and analysis, style optimization in other areas. In the following section, discuss a case drawback, whereby ANN has been enforced for decisive natural frequencies of a cracked cantilever beam (Figure 1).

ARTIFICIAL NEURAL NETWORKS

Artificial neural networks (ANNS) are composed of simple elements operating in parallel. Likened to a biological nervous system, the function of ANN is determined largely by the connections between elements. With explicit knowledge about target values, the network is able to "learn" by adjusting the values between connections (weights between elements). ANNs are widely used to solve problems of classification, prediction, and control [10].

RELATIONSHIP BETWEEN ARTIFICIAL INTELLIGENCE AND MECHANICAL AND ELECTRONIC ENGINEERING

With the rapid development of electronic information, mechanical and electronic engineering as a basic discipline has been widely used in our life. But the mechanical and electronic engineering also has shortcomings, such as the unstable system; the reason of the problem is the imperfect factor of the electronic information system. Artificial intelligence itself can quickly transfer the information and timely process it, which can effectively make up for this shortcoming. In the process of input and output in mechanical and electronic engineering, the electronic information system will face a lot of difficulties and resistance, if the input

information is too complex, electronic information system is likely to make a mistake, then you need to manually solve the problem. If you can combine the two features, you can solve the problems and shortcomings of mechanical and electrical engineering [7].

EXPERT SYSTEM

Expert system (ES) is another important branch of artificial intelligence research [4]. It will explore the general way of thinking into the use of specialized knowledge to solve specific problems. ES will make the theoretical research of the artificial intelligence into practical application; expert system can be seen as a kind of specialized knowledge of computer intelligent program system, it can use expertise and experience provided by experts in specific areas and the use of reasoning techniques in artificial intelligence to solve and simulate complex problems that can often be solved by experts. A basic expert system consists of knowledge base, database, reasoning machine, interpretation mechanism, knowledge acquisition and user interface, as shown in Figure 2.

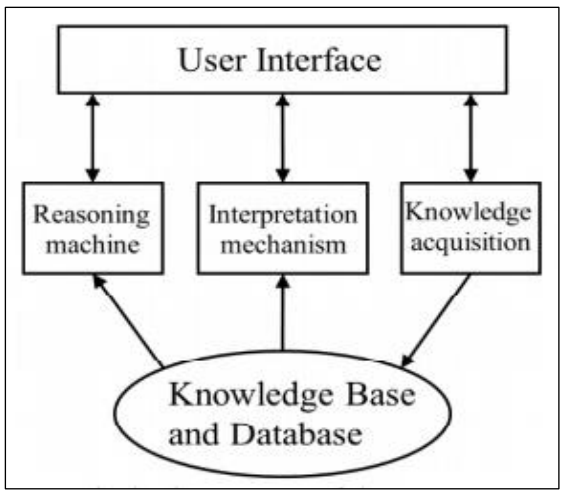

Fig. 2: *The Basic Structure of the Expert System.*

GENETIC ALGORITHMS

Genetic algorithms (GAs) are a subset of Evolutionary Algorithms and are inspired by biology. The main idea of genetic algorithms is to increase individual fitness value during the iterations of evolution process through application of genetic operators, such as mutation or crossover. It leads to evolution of individuals which meet given requirements, represented with so-called fitness function, better than their ancestors. Individuals in population are represented with chromosomes, which are often represented by binary strings but generally they may be represented by other value types. Genes, as parts of chromosomes, are related to specific characteristic of individuals. The main advantage of GAs is that their application does not require any explicit knowledge about the target function. GAs are able to attain good performance within huge amount of potential data set. On the other hand it is difficult to select a sample of primary representative individuals, setting parameters and conditions of selection mechanism. Genetic algorithms are used for solving optimization problems like heat transfer, mass transfer, automobile and internal combustion efficiency purpose, and other mechanical engineering applications [19].

INTELLIGENT DIAGNOSTIC SYSTEM FOR ROTATING MACHINERY

From the situation of fault diagnosis of mechanical equipment, during the development of several years, the theory and method of fault diagnosis technology of rotating machinery has been improved day by day. In practical application, it has achieved great economic benefits. In this study, the fan diagnosis system is used as an example; in fact, it is the universal integrated neural network diagnosis system in the fan fault diagnosis application.

The system is composed of two parts: fan and motor. According to the type of monitoring parameters, the main system can be divided into five subsystems: vibration, temperature, noise, oil and performance, in which the fault diagnosis and decision system is core of the whole intelligent system [20].

APPLICATION OF FAULT DIAGNOSIS TO HOT FILM FORGING PRESS

In the process of production of hot forging presses, it will produce some common serious problems, such as the slider stopped outside the location of the top dead center, stuffy car, the main motor current is too high, lubrication failure. There are many reasons for these

failures, and the fault diagnosis method of hot forging press can be combined with rule reasoning and case reasoning [11]. The fault diagnosis of the production process of hot forging press is based on the rule reasoning and the case reasoning. The system carries out the relevant rule reasoning and case reasoning according to the case in the case library and establishes the number of failures. And the nearest neighbour algorithm is used to analyse the similarity of case matching.

CONCLUSION

From the preceding discussion and case study, it is often seen that ANN will facilitate save time and efforts for advanced issues, wherever analytical techniques are terribly tough and tedious to use. Application of ANN within the case drawback eliminates the necessity to transform the beam over and once more for various crack parameters and rerun the iron analysis. Rather we will simulate the beam sometimes to induce enough information for neural network coaching; then remainder of the specified output values are often obtained from the neural network itself. There are numerous benefits of ANN over typical approaches. Reckoning on the character of the applying and therefore the strength of the inner information patterns you'll usually expect a network to coach quite well. This is applicable to issues wherever the relationships could also be quite dynamic or non-linear. Engineers, regardless of their branch or field are beginning to bank more and more on AI techniques.

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