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Hot topic for project, thesis, and research – Machine Learning

Machine Learning is a new trending field these days and is an application of artificial intelligence. Machine learning uses certain statistical algorithms to make computers work in a certain way without being explicitly programmed. The algorithms receive an input value and predict an output for this by the use of certain statistical methods. The main aim of machine learning is to create intelligent machines which can think and work like human beings. Talking about project and **M.Tech thesis**, machine learning is a hot topic to choose.

Why?

Because it is a new emerging technology and most people are not aware of this technology. With your research work, you can put forward some interesting postulates of this concept. You can get thesis guidance or project assistance in this topic from an

expert.

So let's start with machine learning.

First of all…

What exactly is machine learning?

Find the link at the end to download the latest topics for thesis and research in Machine Learning

What is Machine Learning?

Machine Learning is a branch of **artificial intelligence** that gives systems the ability to learn automatically and improve themselves from the experience without being explicitly programmed or without the intervention of human. Its main aim is to make computers learn automatically from the experience.

Requirements of creating good machine learning systems

So what is required for creating such machine learning systems? Following are the things required in creating such machine learning systems:

- **Data** – Input data is required for predicting the output.
- **Algorithms** – Machine Learning is dependent on certain statistical algorithms to determine data patterns.
- **Automation** – It is the ability to make systems operate automatically.
- **Iteration** – The complete process is iterative i.e. repetition of process.
- **Scalability** – The capacity of the

machine can be increased or decreased in size and scale.

- **Modeling –** The models are created according to the demand by the process of modeling.

Methods of Machine Learning

Machine Learning methods are classified into certain categories. These are:

- **Supervised Learning –** In this method, input and output is provided to the computer along with feedback during the training. The accuracy of predictions by the computer during training is also analyzed. The main goal of this training is to make computers learn how to map input to the output.

- **Unsupervised Learning –** In this case, no such training is provided leaving computers to find the output on its own. Unsupervised learning is mostly applied on transactional data. It is used in more complex tasks. It uses another approach of iteration known as deep learning to arrive at some conclusions.

- **Reinforcement Learning –** This type of learning uses three components namely – agent, environment, action. An agent is the one that perceives its surroundings, an environment is the one with which an agent interacts and acts in that environment. The main goal in reinforcement learning is to find the best possible policy.

How does machine learning work?

Machine learning makes use of processes similar to that of data mining. Machine learning algorithms are described in terms of target function(f) that maps input variable (x) to an output variable (y). This can be represented as:

$y=f(x)$

There is also an error e which is the independent of the input variable x. Thus the more generalized form of the equation is:

$y=f(x) + e$

In machine the mapping from x to y is done for predictions. This method is known as predictive modeling to make most accurate predictions. There are various assumptions for this function.

Benefits of Machine Learning

Everything is dependent on machine learning. Find out what are the benefits of machine learning.

- **Decision making is faster –** Machine learning provides the best possible outcomes by prioritizing the routine decision-making processes.
- **Adaptability –** Machine Learning provides the ability to adapt to new changing environment rapidly. The environment changes rapidly due to the fact that data is being constantly updated.
- **Innovation –** Machine learning uses advanced algorithms that improve the

overall decision-making capacity. This helps in developing innovative business services and models.

- **Insight –** Machine learning helps in understanding unique data patterns and based on which specific actions can be taken.
- **Business growth –** With machine learning overall business process and workflow will be faster and hence this would contribute to the overall business growth and acceleration.
- **Outcome will be good –** With machine learning the quality of the outcome will be improved with lesser chances of error.

Branches of Machine Learning

Computational Learning Theory – Computational learning theory is a subfield of machine learning for studying and analyzing the algorithms of machine learning. It is more or less similar to supervised learning.

Adversarial Machine Learning – Adversarial machine learning deals with the interaction of machine learning and computer security. The main aim of this technique is to look for safer methods in machine learning to prevent any form of spam and malware. It works on the following three principles:

- Finding vulnerabilities in machine learning algorithms.
- Devising strategies to check these potential vulnerabilities.
- Implementing these preventive

measures to improve the **security** of the algorithms.

Quantum Machine Learning – This area of machine learning deals with quantum physics. In this algorithm, the classical data set is translated into quantum computer for quantum information processing. It uses Grover's search algorithm to solve unstructured search problems.

Predictive Analysis – Predictive Analysis uses statistical techniques from data modeling, machine learning and data mining to analyze current and historical data to predict the future. It extracts information from the given data. Customer relationship management(CRM) is the common application of predictive analysis.

Robot Learning – This area deals with the interaction of machine learning and robotics. It employs certain techniques to make robots to adapt to the surrounding environment through learning algorithms.

Grammar Induction – It is a process in machine learning to learn formal grammar from a given set of observations to identify characteristics of the observed model. Grammar induction can be done through genetic algorithms and greedy algorithms.

Meta-Learning – In this process learning algorithms are applied on meta-data and mainly deals with automatic learning algorithms.

Best Machine Learning Tools

Here is a list of artificial intelligence and

machine learning tools for developers:

1. **ai-one –** It is a very good tool that provides software development kit for developers to implement artificial intelligence in an application.

2. **Protege –** It is a free and open-source framework and editor to build intelligent systems with the concept of ontology. It enables developers to create, upload and share applications.

3. **IBM Watson –**It is an open-API question answering system that answers questions asked in natural language. It has a collection of tools which can be used by developers and in business.

4. **DiffBlue –** It is another tool in artificial intelligence whose main objective is to locate bugs, errors and fix weaknesses in the code. All such things are done through automation.

5. **TensorFlow –** It is an open-source software library for machine learning. TensorFlow provides a library of numerical computations along with documentation, tutorials and other resources for support.

6. **Amazon Web Services –**Amazon has launched toolkits for developers along with applications which range from image interpretation to facial recognition.

7. **OpenNN –** It is an open-source, high-performance library for advanced analytics and is written in C++ programming language. It implements neural networks. It has a lot of tutorials

and documentation along with an advanced tool known as Neural Designer.

8. **Apache Spark –** It is a framework for large-scale processing of data. It also provides a programming tool for deep learning on various machines.
9. **Caffe –** It is a framework for deep learning and is used in various industrial applications in the area of speech, vision and expression.
10. **Veles –** It is another deep learning platform written in C++ language and make use of python language for interaction between the nodes.

Machine Learning Applications

Following are some of the applications of machine learning:

- Cognitive Services
- Medical Services
- Language Processing
- Business Management
- Image Recognition
- Face Detection
- Video Games
- Computer Vision
- Pattern Recognition

Machine Learning in Bioinformatics

Bioinformatics term is a combination of two terms bio, informatics. Bio means related to biology and informatics means

information. Thus bioinformatics is a field that deals with processing and understanding of biological data using computational and statistical approach. Machine Learning has a number of applications in the area of bioinformatics. Machine Learning find its application in the following subfields of bioinformatics:

Genomics – Genomics is the study of DNA of organisms. Machine Learning systems can help in finding the location of protein-encoding genes in a DNA structure. Gene prediction is performed by using two types of searches named as extrinsic and intrinsic. Machine Learning is used in problems related to DNA alignment.

Proteomics – Proteomics is the study of proteins and amino acids. Proteomics is applied to problems related to proteins like protein side-chain prediction, protein modeling, and protein map prediction.

Microarrays – Microarrays are used to collect data about large biological materials. Machine learning can help in the data analysis, pattern prediction and genetic induction. It can also help in finding different types of cancer in genes.

System Biology – It deals with the interaction of biological components in the system. These components can be DNA, RNA, proteins and metabolites. Machine Learning help in modeling these interactions.

Text mining – Machine learning help in extraction of knowledge through natural

language processing techniques.

Deep Learning

Deep Learning is a part of the broader field machine learning and is based on data representation learning. It is based on the interpretation of artificial neural network. Deep Learning algorithm uses many layers of processing. Each layer uses the output of previous layer as an input to itself. The algorithm used can be supervised algorithm or unsupervised algorithm. Deep Learning is mainly developed to handle complex mappings of input and output. It is another hot topic for M.Tech thesis and project along with machine learning.

Deep Neural Network

Deep Neural Network is a type of Artificial Neural Network with multiple layers which are hidden between the input layer and the output layer. This concept is known as feature hierarchy and it tends to increase the complexity and abstraction of data. This gives network the ability to handle very large, high-dimensional data sets having millions of parameters. The procedure of deep neural networks is as follows:

1. Consider some examples from a sample dataset.
2. Calculate error for this network.
3. Improve weight of the network to reduce the error.
4. Repeat the procedure.

Applications of Deep Learning

Here are some of the applications of Deep Learning:

- Automatic Speech Recognition
- Image Recognition
- Natural Language Processing
- Toxicology
- Customer Relationship Management
- Bioinformatics
- Mobile Advertising

Advantages of Deep Learning

Deep Learning helps in solving certain complex problems with high speed which were earlier left unsolved. Deep Learning is very useful in real world applications. Following are some of the main advantages of deep learning:

- **Eliminates unnecessary costs** – Deep Learning helps to eliminate unnecessary costs by detecting defects and errors in the system.
- **Identifies defects which otherwise are difficult to detect –** Deep Learning helps in identifying defects which left untraceable in the system.
- **Can inspect irregular shapes and patterns –** Deep Learning can inspect irregular shapes and patterns which is difficult for machine learning to detect.

From this introduction, you must have known that why this topic is called as hot for your M.Tech thesis and projects. This was just the basic introduction to

machine learning and deep learning. There is more to explore in these fields. You will get to know more once you start doing research on this topic for your M.Tech thesis. You can get thesis assistance and guidance on this topic from experts specialized in this field.

Thesis and Research Topics in Machine Learning

Here is the list of current thesis and research topics in Machine Learning:

- Machine Learning Algorithms
- Computer Vision
- Supervised Machine Learning
- Unsupervised Machine Learning
- Deep Learning
- Neural Networks
- Reinforcement Learning
- Predictive Learning
- Bayesian Network
- Data Mining

Machine Learning Algorithms

For starting with Machine Learning, you need to know some algorithms. Machine Learning algorithms are classified into three categories which provide the base for machine learning. These categories of algorithms are supervised learning, unsupervised learning, and reinforcement learning. The choice of algorithms depends upon the type of tasks you want to be done along with the type, quality, and nature of data present.

The role of input data is crucial in machine learning algorithms.

Computer Vision

Computer Vision is a field that deals with making systems that can read and interpret images. In simple terms, computer vision is a method of transmitting human intelligence and vision in machines. In computer vision, data is collected from images which are imparted to systems. The system will take action according to the information it interprets from what it sees.

Supervised Machine Learning

It is a good topic for machine learning masters thesis. It is a type of machine learning algorithm in which makes predictions based on known data-sets. Input and output is provided to the system along with feedback. Supervised Learning is further classified into classification and regression problems. In the classification problem, the output is a category while in regression problem the output is a real value.

Unsupervised Machine Learning

It is another category of machine learning algorithm in which input is known but the output is not known. Prior training is not provided to the system as in case of supervised learning. The main purpose of unsupervised learning is to model the underlying structure of data. Clustering and Association are the two types of unsupervised learning problems. k-means and Apriori algorithm are the examples of unsupervised learning algorithms.

Deep Learning

Deep Learning is a hot topic in Machine Learning. It is already explained above. It is a part of the family of machine learning and deals with the functioning of the artificial neural network. Neural Networks are used to study the functioning of the human brain. It is one of the growing and exciting field. Deep learning has made it possible for the practical implementation of various machine learning applications.

Neural Networks

Neural Networks are the systems to study the biological neural networks. It is an important application of machine learning and a good topic for masters thesis and research. The main purpose of Artificial Neural Network is to study how the human brain works. It finds its application in computer vision, speech recognition, machine translation etc. Artificial Neural Network is a collection of nodes which represent neurons.

Reinforcement Learning

Reinforcement Learning is a category of machine learning algorithms. Reinforcement Learning deals with software agents to study how these agents take actions in an environment in order to maximize their performance. Reinforcement Learning is different from supervised learning in the sense that correct input and output parameters are not provided.

Predictive Learning

Predictive Learning is another good topic for thesis in machine learning. In

this technique, a model is built by an agent of its environment in which it performs actions. There is another field known as predictive analytics which is used to make predictions about future events which are unknown. For this, techniques like data mining, statistics, modeling, machine learning, and artificial intelligence are used.

Bayesian Network

It is a network that represents probabilistic relationships via Directed Acyclic Graph(DAG). There are algorithms in Bayesian Network for inference and learning. In the network, a probability function is there for each node which takes an input to give probability to the value associated with the node. Bayesian Network finds its application in bioinformatics, image processing, and computational biology.

Data Mining

Data Mining is the process of finding patterns from large data-sets to extract valuable information to make better decisions. It is a hot area of research. This technology use method from machine learning, statistics, and database systems for processing. There exist data mining techniques like clustering, association, decision trees, classification for the data mining process.

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