2CSDE85 - Artificial Intelligence

Practical 1

Author: Darshil Maru 20BCE514

Instructor: Prof. Jigna Patel

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What is AI?

Artificial intelligence (AI) as the basis for mimicking human intelligence processes and perhaps exceeding this intelligence through the creation and application of algorithms built into a dynamic computing environment

Major areas of artificial intelligence:

1. **Machine Learning**
   - Subset of AI.
   - Machine Learning (ML) needs users to feed input data in its algorithms.
   - Its decision making is made based on the set of input historical data. If any alterations are made to the data, it recomputes and incorporates the changes in decision making.

   Application of ML:
   - Image Recognition
   - Speech Recognition
   - Email Spam and Malware filtering

2. **Deep Learning**
   - Subsection of Machine Learning which does not need human supervision.
   - Process of learning is through analyzing input data of all formats and patterns.
   - This unrefined data is collected, classified and labeled into sub-sections based on similarity.

   However, Deep learning at the initial stage is guided to understand and correlate various human behavior and attitudes. This learning is inclusive of

   - Reading various types of human emotions
   - Identifying and differentiating humans and animals through images
   - Knowledge of their habits, gestures, features, locations etc
   - Voice recognition of the people, trying to understand their accent, nasal tone, etc

Application of DL:
- Self-driving cars
- News Aggregation and Fraud News Detection
- Detecting developmental delay in children

3. Computer Vision
- Computer vision forms an integral part of 'Deep Learning'.
- Human vision tutors its brain for a lifelong study through various forms of living or non-living visuals.
- It is classifying to the needs of a person; like correct or incorrect, stay or move, conflict or resolve etc.
- The brain decision making is possible due to help received from retinas, optics nerve and visual cortex.

CV uses visuals extracted from various sources such as digital content, graphics, documents etc. This acquired skill helps the system to immediately identify, examine, decode and choose in real time situations.

This technology is already utilized and is benefiting in sectors such as health care and defense etc.

Applications of CV:
- Self-Driving Cars
- Pedestrian Detection
- Cancer Detection

4. Natural Language Processing

Natural language processing is a branch of artificial intelligence that helps computers understand, interpret and manipulate human language.

Natural language processing draws from many disciplines including computers science and computational linguistics in its pursuit to fill the gap between human communication and computer understanding.

Applications:
- Email filter
- Smart assistants
- Search results

- Predictive text
- Language translation
- Digital phone calls

5. **Neural Network**

The role of neutral networks in AI is parallel to the role of the brain in human anatomy. It is an alchemy between mathematics and statistics. The use of 'neuron' for collecting and classification according to labels (mathematics) and network is akin to regressions analysis (statistics).

This network contains layers of interconnected nodes similar to multiple linear regressions. There are three main layers namely
- The input layer - for storing input patterns
- The hidden layer - for fine tuning input layers until the margin of error is reduced to zero. It is assumed that this layer triggers the input layer for predicting the outputs.
- The output layer - for classification and mapping input layers.

Applications:
- Facial Recognition
- Stock Market Prediction
- Aerospace
- Weather Forecasting

AI Tools & Frameworks:

Artificial Intelligence has facilitated the processing of a large amount of data and its use in the industry. The number of tools and frameworks available to data scientists and developers has increased with the growth of AI and ML. Some of them are listed below:

1. **Scikit Learn**
   - It is one of the most well known ML libraries.
   - It underpins many administered and unsupervised learning calculations. Precedents incorporate direct and calculated relapses, choice trees, bunching, k-implies, etc.

   - It expands on two essential libraries of Python, NumPy and SciPy.
   - It includes a lot of calculations for regular AI and data mining assignments, including bunching, relapse and order. Indeed, even undertakings like changing information, feature determination and ensemble techniques can be executed in a couple of lines.
   - For a fledgeling in ML, Scikit-learn is a more-than-adequate instrument to work with, until you begin actualizing progressively complex calculations.

Applications of Scikit:
   - Supervised Learning Algorithms
   - Feature Extraction
   - Cross-validation
   - Dimensionality Reduction
   - Clustering

Pros:
   - Free with minimal legal and licensing restrictions.
   - Versatile and handy and serves real-world purposes like the prediction of consumer behavior, the creation of neuroimages, etc.

Cons:
   - It is not the best choice for in-depth learning.

2. Tensorflow

- The fascinating thing about Tensorflow is that when you compose a program in Python, you can arrange and keep running on either your CPU or GPU. So you don't need to compose at the C++ or CUDA level to keep running on GPUs.

- It utilizes an arrangement of multi-layered hubs that enables you to rapidly set up, train, and send counterfeit neural systems with huge datasets. This is the thing that enables Google to recognize questions in photographs or comprehend verbally expressed words in its voice-acknowledgement application.

Applications of TensorFlow:
- Speech Recognition Systems
- Image/Video Recognition
- Self Driving Cars
- Sentiment Analysis

Pros:
- Open-Source Platform
- Data Visualization
- Keras friendly
- Scalable
- Parallelism
- Graphical Support

Cons:
- Frequent Updates
- Inconsistent
- Dependency
- GPU Support
- Support for Windows

3. PyTorch:
- PyTorch is a framework of deep learning, and it is a Python machine learning package based on Torch.
- PyTorch is a Machine Learning Library for Python programming language which is used for applications such as Natural Language Processing.

Features of PyTorch:
- Simple Interface
- Hybrid Front-end
- Distributed Training
- Cloud Partners

Applications of PyTorch:
- Computer Vision
- NLP
- Reinforcement Learning

Pros:
- It is easy to learn and simpler to code.
- Rich set of powerful APIs to extend the Pytorch Libraries.
- It has computational graph support at runtime.
- It is flexible, faster, and provides optimizations.
- It has support for GPU and CPU.
- Easy to debug using Pythons IDE and debugging tools.

Cons:
- It has been released in 2016, so it's new compared to others and has fewer users, and is not widely known.
- Absence of monitoring and visualization tools like a tensor board.
- The developer community is small compared to other frameworks.

4. **Keras**

   Keras is very useful for beginners starting with neural networks. It is a high-level framework that hides the backend computation and allows us to quickly build a neural network model.

Keras Features:
- Prelabeled Datasets
- Numerous implemented layers and parameters
- Multiple methods for Data Preprocessing
- Model Evaluation

Pros:
- User friendly and fast deployment
- Quality documentation and large community support.
- Multiple backend and modularity
- Pretrained Models

Cons:
- Problems in low-level API
- Slower than its backend

Conclusion:

In this practical I learned about AI, Various domains of AI, Tools & Frameworks used for AI.