NAGA COLLEGE FOUNDATION, INC.
CSFE5: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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Answer the following:

1. Define Machine Learning

Machine learning is an area of artificial intelligence that uses algorithms trained on data sets to construct models that allow machines to do jobs that would otherwise be limited to humans, such as picture classification, data analysis, and price prediction.

2. Brief history of machine learning

1950	**Arthur Samuel** from **IBM** created a computer program for **playing checkers**. Because the application had very little computer memory available, Samuel commenced alpha-beta pruning. His concept includes a scoring system based on the locations of the pieces on the board. The scoring function attempts to calculate the probability of each side prevailing. The software selects its next move using a minimax strategy, which developed into the minimax algorithm.
1957	**Frank Rosenblatt**, of the Cornell Aeronautical Laboratory, coupled Donald Hebb's model of brain cell interaction with Arthur Samuel's machine learning work to produce the perceptron. The **perceptron** was first designed as a mechanism rather than a software. The program, initially created for the IBM 704, was put in the **Mark 1**

	perceptron, a machine built specifically for image recognition. This made the software and algorithms portable and accessible to other machines.
1967	The **closest neighbor algorithm** was developed, which marked the start of rudimentary pattern recognition. This technique was used to map routes and was one of the first algorithms to solve the traveling salesperson's challenge of determining the most effective path. Using it, a salesman inputs a certain city and instructs the computer to visit the neighboring cities until all are visited. **Marcello Pelillo** is credited with creating the "nearest neighbor rule."
1970s	**Backpropagation** is a technique that allows a network's hidden layers of neurons/nodes to alter in response to new conditions. It covers "the backward propagation of errors," which involves processing an error at the output and then propagating it backward through the network's layers for learning purposes. Backpropagation is currently often used to train deep neural networks.
Late 1970s - Early 1980s	Artificial intelligence research emphasized logical, knowledge-based techniques above algorithms. Researchers in computer science and artificial intelligence have also abandoned neural network research. This resulted in a rift between artificial intelligence and machine learning. Previously, machine learning was employed as a training method for AI.

1990	"**Boosting**" was an essential step in the advancement of machine learning. Boosting algorithms are used to **eliminate bias** in supervised learning, and they include machine learning algorithms that turn weak learners into strong ones. Robert Schapire's 1990 study, "The Strength of Weak Learnability," introduced the notion of boosting. According to Schapire, "A set of weak learners can create a single strong learner." Weak learners are classifiers that are only weakly connected with the real classification (but still superior to random guessing). In contrast, a strong learner is quickly identified and closely matched with the genuine categorization.
1997	Currently, much of voice recognition training is performed using a Deep Learning approach known as long short-term memory (LSTM), a neural network model established by Jürgen Schmidhuber and Sepp Hochreiter. LSTM can learn tasks that require recollection of events that occurred thousands of discrete steps ago, which is very useful for speech.
2006	The **Facial Recognition Grand Challenge,** a National Institute of Standards and Technology initiative, assessed prominent facial recognition algorithms of the time. 3D face scans, iris pictures, and high-resolution face images were evaluated. Their findings indicated that the new algorithms were ten times more accurate than the facial recognition algorithms from 2002 and 100 times more accurate than those from 1995. Some of the algorithms outperformed human participants in recognizing faces and identifying identical twins.

2007	Long short-term memory began to beat more typical voice recognition methods. In 2015, the Google voice recognition software allegedly improved by 49 percent utilizing a CTC-trained LSTM.
2012	Google's X Lab created a machine learning system capable of browsing and finding movies involving cats on its own. In 2014, Facebook created DeepFace, an algorithm that can recognize or verify persons in images with the same accuracy as humans.
Present	Some of the most significant technological developments are now being driven by machine learning. It is being employed in the burgeoning industry of self-driving automobiles, as well as for galactic exploration by assisting in the identification of exoplanets. Stanford University recently defined machine learning as "the science of getting computers to act without being explicitly programmed." Machine learning has spawned a slew of new concepts and technologies, such as supervised and unsupervised learning, new robot algorithms, the Internet of Things, analytics tools, chatbots, and more. The following are seven common applications of machine learning in the business sector today: ● Analyzing Sales Data: Streamlined Data ● Real-time Mobile Personalization: Promoting the Experience ● Fraud Detection: Pattern Changes ● Product recommendations: Customer personalization ● Learning Management Systems: Decision-making programs.

	• Dynamic pricing: Flexible pricing based on need or demand. • Natural Language Processing: Communicating with humans Google is actively working with machine learning using a method known as **instruction fine-tuning**. The purpose is to train an ML model to address natural language processing problems in a generic manner. The method prepares the model to address a variety of issues rather than just one type of problem.

3. Terminologies of Machine learning

Table 1: The three components of learning algorithms.

Representation	Evaluation	Optimization
Instances	Accuracy/Error rate	Combinatorial optimization
K-nearest neighbor	Precision and recall	Greedy search
Support vector machines	Squared error	Beam search
Hyperplanes	Likelihood	Branch-and-bound
Naive Bayes	Posterior probability	Continuous optimization
Logistic regression	Information gain	Unconstrained
Decision trees	K-L divergence	Gradient descent
Sets of rules	Cost/Utility	Conjugate gradient
Propositional rules	Margin	Quasi-Newton methods
Logic programs		Constrained
Neural networks		Linear programming
Graphical models		Quadratic programming
Bayesian networks		
Conditional random fields		

- **Clustering**, as defined in a machine learning glossary, is an unsupervised learning strategy that groups unlabeled data items based on their characteristics and qualities.
- **Classification**, a component of supervised learning that uses labeled data, is classifying data inputs into separate groups. Classification in machine learning might comprise binary classifiers with two outputs (for example, spam or non-spam) or

multi-class classifiers that discriminate between several categories such as book kinds or animal species.

- **Regression** develops links and correlations between different data types. For example, in image analysis, profile photos are made out of pixels that represent persons. Recognizing precise pixel patterns that match to a person's name by machine learning allows for facial recognition, as shown when Facebook offers tags for freshly submitted photographs.
- **Deep learning** is an extension of machine learning that mimics the functions of the human brain. Deep learning employs neural networks to evaluate enormous amounts of data (both organized and unstructured) and detect patterns within it. Deep learning networks' choices get more accurate and insightful as the number of data from which they can learn increases.
- **Neural networks**, which are closely related to deep learning, are composed of consecutive layers of neurons that improve data understanding for accurate analysis. A neural network, which consists of layers of nodes, accepts data input and stimulates these nodes. Coefficients add weights to this data, as certain inputs may be more important than others in the network analysis.
- **Natural language processing (NLP)**, an important topic in artificial intelligence, focuses on the processing of human languages. However, one major difficulty is that human communication is not always literal. It includes dialect-specific machine-learning terminology, figures of speech, cultural subtleties, and phrases that have different meanings depending on syntax and punctuation. To properly

comprehend language, NLP systems must take syntax (word arrangement) and semantics (meaning of the arrangement) into account, just as humans do.

- **Machine vision**, or **computer vision**, is the process of collecting and processing pictures by machines. This capacity makes it easier to diagnose skin cancer by reviewing X-rays and medical images, as well as detect real-time traffic and identify vehicle kinds, which is critical for improvements in self-driving cars like Tesla's current models.

4. Elements of Machine learning

The key elements of machine learning are the following:

1. **Representation**: Refers to the model's look and how knowledge is displayed.
2. **Evaluation**: Concerns in distinguishing between excellent models and the program assessment process.
3. **Optimization:** Process of identifying successful models and creating programs and methods that are ‘effective’.

5. Tasks of Machine Learning

1. Regression
2. Classification
3. Clustering
4. Transcription
5. Machine translation
6. Anomaly detection
7. Synthesis & sampling
8. Estimation of probability density and probability mass function
9. Similarity matching
10. Co-occurrence grouping
11. Causal modeling
12. Link profiling

6. Machine learning process

These are the following processes that usually occur in machine learning.

1. Data gathering
2. Data preprocessing
3. Exploratory data analysis (EDA)
4. Feature engineering including feature creation/extraction, feature selection, dimensionality reduction
5. Training machine learning models
6. Model / Algorithm selection
7. Testing and matching
8. Model monitoring
9. Model retraining

References:

Staff, C. (2023, September 11). *What is machine learning? Definition, types, and examples*. Coursera. https://www.coursera.org/articles/what-is-machine-learning

Foote, K. D. (2021, December 3). *A brief history of machine learning*. DATAVERSITY. https://www.dataversity.net/a-brief-history-of-machine-learning/

Davidson, L. (2019, April 30). *The most common machine learning terms, explained*. Springboard.

https://www.springboard.com/blog/data-science/machine-learning-terminology/

Simplilearn. (2024, January 29). 10 essential machine learning terms you need to know. *Simplilearn*. https://www.simplilearn.com/essential-machine-learning-terms-article