intro

Machine learning is a subfield of artificial intelligence that involves the development of algorithms and statistical models that enable computers to improve their performance in tasks through experience. These algorithms and models are designed to learn from data and make predictions or decisions without explicit instructions. There are several types of machine learning, including supervised learning, unsupervised learning, and reinforcement learning. Supervised learning involves training a model on labeled data, while unsupervised learning involves training a model on unlabeled data. Reinforcement learning involves training a model through trial and error. Machine learning is used in a wide variety of applications, including image and speech recognition, natural language processing, and recommender systems.

Machine learning (ML) is a fascinating field that's transforming the way we interact with computers. Here's a quick breakdown to get you started:

**Essentially, it's about teaching computers to learn from data.** Unlike traditional programming where you provide explicit instructions, machine learning algorithms can analyze data, identify patterns, and make predictions on their own.

**Think of it as this:** Imagine you're training a friend to identify different dog breeds. You show them pictures of poodles, labradors, and bulldogs, pointing out the distinguishing features. Over time, your friend learns to recognize these breeds on their own – that's machine learning in action.

**Here's why it's so powerful:**

* **Makes data-driven decisions:** Machine learning algorithms can sift through massive amounts of data to uncover hidden patterns and trends. This allows them to make more accurate decisions and predictions.
* **Automates tasks:** Machine learning can automate repetitive tasks that would be tedious or time-consuming for humans. For example, filtering emails or recommending products.
* **Continuously learns and improves:** As machine learning algorithms are exposed to more data, they keep getting better at what they do.

**There are different types of machine learning, but two main ones are:**

* **Supervised learning:** This is where the data is labeled. Like showing your friend pictures of specific dog breeds. The algorithm learns from these examples and can then classify new, unseen data.
* **Unsupervised learning:** Here, the data is unlabeled. Imagine showing your friend a bunch of dog pictures without saying what breeds they are. The algorithm would have to find the patterns and groupings by itself.

Machine learning is having a huge impact on our world, from facial recognition software to self-driving cars. If you're interested in learning more, there are plenty of online resources and courses available.

What is ML?

Machine learning (ML) is a branch of [artificial intelligence (AI)](https://www.ibm.com/topics/artificial-intelligence" \t "/home/ubunto\\x/_self) and computer science that focuses on the using data and algorithms to enable AI to imitate the way that humans learn, gradually improving its accuracy.

Machine Learning is the field of study that gives computers the capability to learn without being explicitly programmed. ML is one of the most exciting technologies that one would have ever come across. As it is evident from the name, it gives the computer that makes it more similar to humans: The ability to learn. Machine learning is actively being used today, perhaps in many more places than one would expect.

How does machine learning work?

Absolutely! Let's dive into an example of a machine learning architecture for image classification. This is a type of supervised learning where we want the model to identify objects in pictures.

Imagine we're building a system to sort clothes images into categories like shirts, pants, and dresses. Here's a simplified breakdown of the architecture:

**Data Acquisition:** First, we collect a large dataset of images containing labeled clothing items. This is crucial for supervised learning as the labels act as the training guide for the model.

**Data Preprocessing:** The images might need some pre-processing before feeding them to the model. This could involve resizing them to a standard size, adjusting brightness and contrast, or converting them to a specific format.

**Model Training:** This is where the magic happens! We choose a suitable machine learning model, like a Convolutional Neural Network (CNN) often used for image recognition. The preprocessed images and their corresponding labels are fed into the CNN. The model analyzes the data, identifying patterns and features that differentiate shirts from pants, and so on.

**The CNN Architecture:** Here's a simplified view inside the CNN:

* 1. **Convolutional Layers:** These layers apply filters to the image, extracting features like edges, shapes, and colors. Imagine the filter scanning the image, identifying specific patterns.
  2. **Pooling Layers:** These layers reduce the data size by summarizing the information from the convolutional layers. Like summarizing the key points from each filtered scan of the image.
  3. **Fully Connected Layers:** These layers connect all the extracted features and translate them into probabilities of belonging to a specific clothing category (shirt, pants, dress).

**Model Evaluation:** After training, we test the model with a separate dataset of labeled images. This helps us assess how accurate the model is in classifying new, unseen clothing images.

**Model Deployment:** If the model performs well, we can deploy it to a real-world application. For example, integrating it into a website that automatically categorizes uploaded clothing images.

**Monitoring and Improvement:** Even after deployment, we might monitor the model's performance and retrain it with new data to ensure it stays accurate over time.

This is a basic example, and different machine learning problems might require more complex architectures. But it hopefully gives you an idea of the building blocks involved in creating and using machine learning models.

Machine learning uses two types of techniques: supervised learning, which trains a model on known input and output data so that it can predict future outputs, and unsupervised learning, which finds hidden patterns or intrinsic structures in input data.

Machine Learning is, undoubtedly, one of the most exciting subsets of Artificial Intelligence. It completes the task of learning from data with specific inputs to the machine. It’s important to understand what makes Machine Learning work and, thus, how it can be used in the future.

The Machine Learning process starts with inputting training data into the selected algorithm. Training data being known or unknown data to develop the final Machine Learning algorithm. The type of training data input does impact the algorithm, and that concept will be covered further momentarily.

New input data is fed into the machine learning algorithm to test whether the algorithm works correctly. The prediction and results are then checked against each other.

If the prediction and results don’t match, the algorithm is re-trained multiple times until the data scientist gets the desired outcome. This enables the machine learning algorithm to continually learn on its own and produce the optimal answer, gradually increasing in accuracy over time.

[UC Berkeley](https://ischoolonline.berkeley.edu/blog/what-is-machine-learning/" \t "/home/ubunto\\x/_blank) (link resides outside ibm.com) breaks out the learning system of a machine learning algorithm into three main parts.

1. A Decision Process: In general, machine learning algorithms are used to make a prediction or classification. Based on some input data, which can be labeled or unlabeled, your algorithm will produce an estimate about a pattern in the data.
2. An Error Function: An error function evaluates the prediction of the model. If there are known examples, an error function can make a comparison to assess the accuracy of the model.
3. A Model Optimization Process: If the model can fit better to the data points in the training set, then weights are adjusted to reduce the discrepancy between the known example and the model estimate. The algorithm will repeat this iterative “evaluate and optimize” process, updating weights autonomously until a threshold of accuracy has been met.

Architecture of ML

Machine learning architecture is the structure and organisation of the many [components](https://lakefs.io/blog/machine-learning-components/" \t "/home/ubunto\\x/_blank) and processes that are part of a machine learning system. It defines how you process data, train and evaluate ML models, and generate predictions. An architecture is basically a model for creating an ML system.

The architecture of a machine learning application will depend on the unique use case and system requirements.

Machine learning ([ML)](https://deepchecks.com/glossary/machine-learning/) architecture is the structure and organization of the different components and processes that comprise a machine learning system. The machine learning architecture specifies how data is handled, models are trained and assessed, and predictions are created. It serves as the template for developing an ML system.

The ML system architecture might vary based on the unique use case and machine learning system needs. A well-designed ML architecture may aid in the development of scalable, dependable, and efficient machine learning systems.

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Today, companies are using Machine Learning to improve business decisions, increase productivity, detect disease, forecast weather, and do many more things. With the exponential growth of technology, we not only need better tools to understand the data we currently have, but we also need to prepare ourselves for the data we will have. To achieve this goal we need to build intelligent machines. We can write a program to do simple things. But most of the time, Hardwiring Intelligence in it is difficult. The best way to do it is to have some way for machines to learn things themselves. A mechanism for learning – if a machine can learn from input then it does the hard work for us. This is where [Machine Learning](https://www.geeksforgeeks.org/machine-learning/) comes into action. Some of the most common examples are:

* Image Recognition
* Speech Recognition
* Recommender Systems
* Fraud Detection
* Self Driving Cars
* Medical Diagnosis
* Stock Market Trading
* Virtual Try On

## Image Recognition

Image Recognition is one of the reasons behind the boom one could have experienced in the field of [Deep Learning](https://www.geeksforgeeks.org/deep-learning-tutorial/). The task which started from classification between cats and dog images has now evolved up to the level of Face Recognition and real-world use cases based on that like employee attendance tracking.

## Speech Recognition

Speech Recognition based smart systems like Alexa and Siri have certainly come across and used to communicate with them. In the backend, these systems are based basically on Speech Recognition systems. These systems are designed such that they can convert voice instructions into text.

## Recommender Systems

As our world has digitalized more and more approximately every tech giants try to provide customized services to its users. This application is possible just because of the [recommender systems](https://www.geeksforgeeks.org/data-mining-and-recommender-systems/) which can analyze a user’s preferences and search history and based on that they can recommend content or services to them.

## Fraud Detection

In today’s world, most things have been digitalized varying from buying toothbrushes or making transactions of millions of dollars everything is accessible and easy to use. But with this process of digitization cases of [fraudulent transactions](https://www.geeksforgeeks.org/online-payment-fraud-detection-using-machine-learning-in-python/) and fraudulent activities have increased. Identifying them is not that easy but machine learning systems are very efficient in these tasks

## Self Driving Cars

It would have been assumed that there is certainly some ghost who is driving a car if we ever saw a car being driven without a driver but all thanks to machine learning and deep learning that in today’s world, this is possible and not a story from some fictional book. Even though the algorithms and tech stack behind these technologies are highly advanced but at the core it is machine learning which has made these applications possible.

The most common example of this use case is that of the Tesla cars which are well-tested and proven for autonomous driving.

## Medical Diagnosis

If you are a machine learning practitioner or even if you are a student then you must have heard about projects like [breast cancer Classification](https://www.geeksforgeeks.org/ml-kaggle-breast-cancer-wisconsin-diagnosis-using-knn/), [Parkinson’s Disease Classification](https://www.geeksforgeeks.org/parkinson-disease-prediction-using-machine-learning-python/), [Pneumonia detection](https://www.geeksforgeeks.org/pneumonia-detection-using-deep-learning/), and many more health-related tasks which are performed by machine learning models with more than 90% of accuracy.

## Stock Market Trading

Stock Market has remained a hot topic among working professionals and even students because if you have sufficient knowledge of the markets and the forces which drives them then you can make fortune in this domain. Attempts have been made to create intelligent systems which can predict future price [trends](https://www.geeksforgeeks.org/what-is-a-trend-in-time-series/) and market value as well.