**Machine Learning Techniques**

**What is Machine Learning and its Techniques**

Machine Learning(ML) is a subfield of Artificial Intelligence(AI). It uses algorithms trained on data sets to create models that enable machines to perform tasks that would otherwise only be possible for humans, such as categorizing images, analysing data, or predicting price fluctuations.

Machine Learning Techniques include:

* **Reinforcement learning**: The algorithm performs actions that will be rewarded the most.
* **Unsupervised machine learning**: The algorithm finds patterns in unlabelled data by clustering and identifying similarities.
* **Supervised machine learning**: The algorithm analyses labelled data and learns how to map input data to an output label.

**What are the Key Challenges of Machine Learning**

There are a number of challenges faced by Machine Learning. These include:

* **Lack of Training Data**: Without sufficient training data, your machine model will not learn properly. In most cases you will require millions of data to train a machine model as well as a large amount of testing data to ensure that the model is working correctly. For example, when training a system to recognise spam emails, you will require millions of records of real clean emails along with real spam emails to train and test the model and these might not always be available.
* **Poor Quality of Data**: If you have a large of data which is full of formatting and typing errors, missing values and duplicates, the machine model will not be able to learn correctly and will therefore, not function as it should. An example of this is when Equifax generated inaccurate credit scores for millions of its customers over several years. As a result of this, lending decisions were affected, and Equifax’s data practices were no longer trusted by the public. The company was heavily fine, faced lawsuits and lost credibility.
* **Overfitting**: Overfitting is where the machine model is overcomplicated but is trying to fit into a limited set of data. This can lead to overgeneralisation where the model works well with the training/testing data, but then makes general assumptions with real world data causing errors. For example, if a diagnostic AI tool is trained on limited patient data, it can lead to overfitting and provide unreliable results.
* **Data Underfitting**: Underfitting is the opposite of overfitting, where the machine model is too simple and is unable to draw useful conclusions from the training data. Taking the previous example, if the model is only using one parameter, like high temperature, but misses out other symptoms, the model with underfit and provide inaccurate results.
* **Irrelevant Features**: Irrelevant features are features within the training data which are not required for the machine model to work properly. Removing irrelevant features from the training data will make the machine model more efficient. For example, when training a model to look for spam emails, you do not require to know how large the email is or when it was sent/received as these do not relate to the email being spam or not.

**How does it help Organisations**

Machine Learning is helping organisations grow revenue, boost operational efficiency and improve customer experiences. This is done through:

* **Better Decision Making**: The increasing use of AI/ML technology to make data driven decisions within organisations has led to better and more accurate decisions instead of ones based on a person’s instincts or intuition tainted by personal biases and preferences.
* **Efficiency and Productivity Gains**: These are two big benefits organisations get from using AI/ML. This is because AI/ML lets organisations handle tasks at a volume and speed that is not capable for a human being to match. AI/ML can be used to analyse data for insights, create software code or execute specific business processes, removing time-consuming manual tasks from workers. This then allows workers to perform higher level tasks which AI/ML is unable to do.
* **Improved Speed of Business**: The use of AI/ML shortens the amount of time taken for an organisation to get from one stage to another in a project, delivering a better return on investment.
* **New Capabilities and Business Model Expansion**: Companies are increasingly using AI/ML to identify new revenue streams to expand their business models.
* **Personalised Customer Services and Experiences**: Companies, such as Netflix, are using AI/ML to analyse and learn from data what their customers prefer to watch or buy so that they can personalise their customers viewing experience and make recommendations. This is also being used in other areas, such as Healthcare to customise treatments as well as work environments to support an employee’s individual requirements.
* **Improved Monitoring**: As AI/ML is able to take in and process very large amounts of data in real time, it allows organisations to implement near instantaneous monitoring capabilities to alert them to issues, recommend actions and, in some cases, initiate a response.
* **Better Quality and Reduction of Human Error**: When AI/ML is integrated with Robotic Process Automation(RPA), it speeds up processes and reduces errors. It can also be trained to improve upon itself and taken on broader tasks.
* **Better Talent Management**: Organisations are now using AI/ML to streamline the hiring process, saving them money in hiring costs by identifying top-tier candidates. AI/ML can also identify and retain high performers, determine equal pay, gauge employee sentiment and deliver more personalised and engaging workplace experiences with less requirements on boring, repetitive tasks.
* **More Innovation**: With the increased use of AI/ML, employees are becoming more comfortable using these tools to be more creative and innovative. This is being implemented in numerous areas from healthcare using it for drug discovery work to retailers using it for new product creation.
* **Increased Profitability**: As AI/ML is used more by organisations, they will see improved productivity, reduced costs, higher efficiency and may even find new opportunities for growth. This can be done through personalising services for customers, supporting innovation and aiding in risk management.

**Recommendations:**

There are a number of recommendations which can be made to try and mitigate the challenges faced by Machine Learning. These are:

* **Data Accuracy**: AI/ML models need to be trained on organisations own data to be able to deliver verifiable results that are accurate and precise and are able to recall. Ensuring that AI responses can be validated by people when there is uncertainty in the responses they have generated is very important. This can be done by citing the sources the AI/ML model is pulling information from and explaining why it has given the response it has, highlighting the uncertainty and creating guardrails to prevent some tasks from being fully automated.
* **Safety**: Conducting bias, explainability and robustness assessments is very important to mitigate bias, toxicity and harmful outputs. The privacy of any personally identifying data within the training dataset must be protected by organisations to prevent any potential harm. Vulnerabilities which can be exploited by bad actors can help to be prevented by security assessments being carried out by organisations.
* **Honesty**: When using data to train and test the model, organisations should ensure that consent to use the data has been given. Using open-source and user-provided data is one way of ensuring this. It’s also important to be transparent regarding any data which has been generated by AI/ML.
* **Sustainability**: Unfortunately, at the moment, AI/ML models are using vast amounts of electricity and water to train as they are using large language models. In the future it would be good to minimize the size of the models while maximizing accuracy. This can be done by training the models on large amounts of high-quality data. This will help organisations become more sustainable leading to a lower carbon footprint.
* **Use Zero-Party or First-Party Data**: When training AI/ML models, organisations should use zero-party or first-party data, rather than relying on data obtained from a third-party. This is because third-party data may be old, inaccurate or have many errors within it.
* **Keep Data Fresh and Well-Labelled**: If data is old, incomplete or inaccurate, this can lead to the AI/ML model producing inaccurate or out of date results. Training data should also be unbiased to reduce the chance of the model producing biased results.
* **Ensure There’s a Human in the Loop**: AI/ML models do not always understand emotional or business context and cannot know when they are wrong or damaging. As a result of this, humans should be involved to review outputs for accuracy, check for any bias and ensure models are operating as intended. AI/ML models should only be used as a way to augment human capabilities and not replace them.
* **Continual Testing**: AI/ML models require constant oversight to ensure that they remain up-to-date, accurate and unbiased. Organisations should ensure they have trained staff to oversee the outputs being generated by the model to check for any accuracy, bias and hallucinations(where a model believes a falsehood is real).
* **Getting Feedback**: Organisations should listen to employees, trusted advisors and impacted communities to identify any risks and correct the course of the model. Obtaining feedback can be done in a number of ways, from focus groups, anonymous hotlines, a mailing list to employee incentives.

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