

# AI 'Buzz' Words

Generative AI - Generates content

Agentic AI - Generate content and performs tasks with agency/on its own -

- Can coordinate with other agents

- Has role, goal, and backstory

ANI Artificial Narrow Intelligence -

- Supervised - Chat Boxes, self driving car. Learns based on inputs

- Unsupervised -

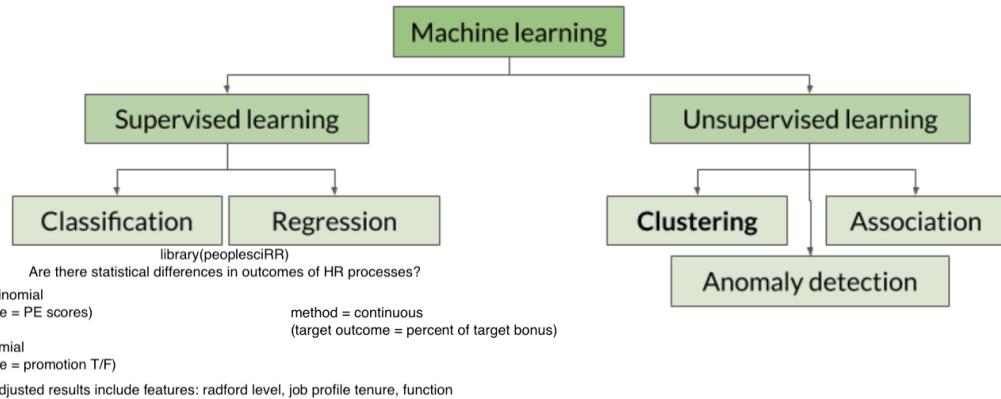
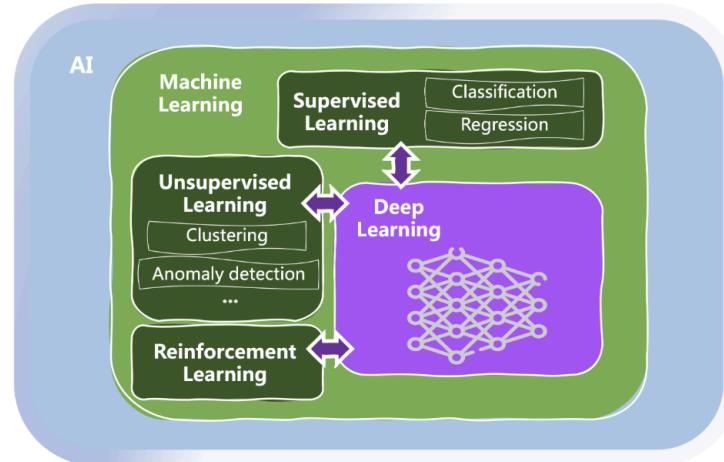
AGI Artificial General Intelligence - Hypothetically. AI is able to reason, learn autonomously, solve complex problems, and adapt to new situations, much like a human.

IoT - Internet of Things - network of physical devices (like sensors and appliances) - detect number of people in room and adjust temperature

RAG - Retrieval Augmented Generation - can use data sources beyond its model's training data to generate an output

# Machine Learning

Source: Datacamp Courses



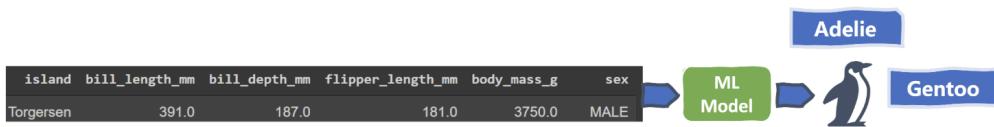
"Predicting the outcome based on gender is the same as seeing how groups differ on the outcome"

## Supervised Learning: classification

**Classification:** assign each data observation the category (*class*) it may belong to

- **Binary classification:** two classes, e.g. positive/negative, male/female, etc.
- **Multi-class classification:** several mutually exclusive classes, e.g. multiple species

**Supervised learning:** *Data annotation* (getting labelled observations with *known class a priori*) needed to learn/train a **model** capable of making inference

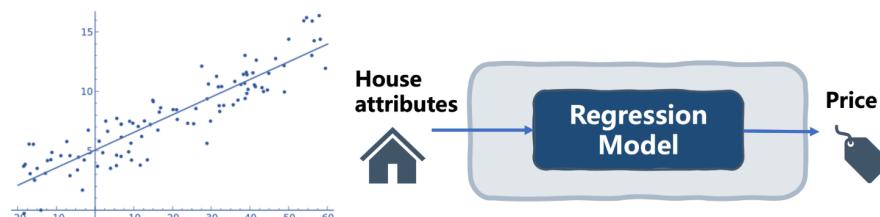


observations to learn from, that is, data instances whose classes are already known.

1:50

## Supervised Learning: regression and forecasting

**Regression:** assign each data observation a numerical output or *label* based on its inputs



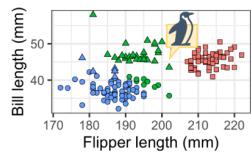
**Time series forecasting:** predict future values of variable, based on its past behavior



For instance, forecasting the number of daily bus passengers for next month, based on historical data.

# Unsupervised and reinforcement learning

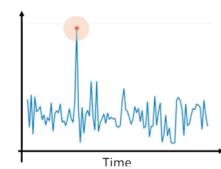
**Clustering:** find subgroups of data with *similar* characteristics (e.g. *k-means* algorithm)



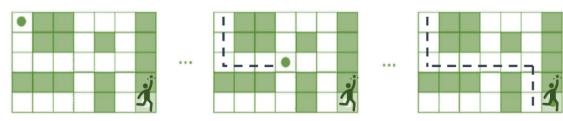
**Association rule discovery:** find common co-occurrences of items in transaction data



**Anomaly detection:** detecting *abnormal* data observations e.g. unusual card transactions



**Reinforcement learning:** learn by *experience* (trial and error) to master a complex task



And in reinforcement learning, an AI agent is trained to solve complex

datacamp

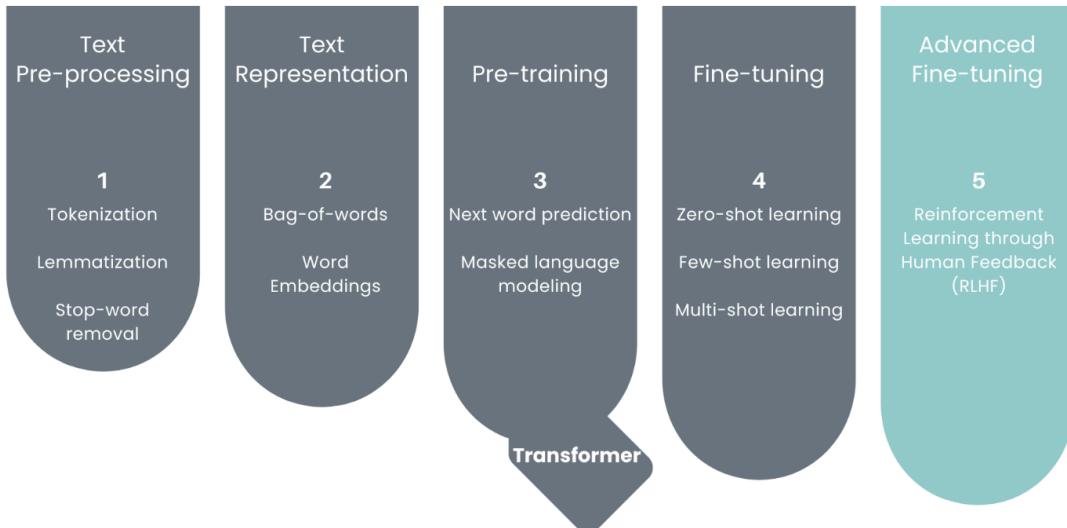
UNDERSTANDING ARTIFICIAL INTELLIGENCE

Clustering package in R: <https://cran.r-project.org/web/packages/mclust/vignettes/mclust.html>

# Deep Learning: LLM

Datacamp course: <https://www.datacamp.com/courses/large-language-models-langs-concepts>

Building Blocks of LLM



## Text pre processing

Tokenization: "Working with natural language processing techniques is tricky" ["Working", "with", "natural", "language", "processing", "techniques", "is", "tricky", "."].  
Lemmatization: This process of reducing words to their base form is known as lemmatization. For example, "talking", "talked", and "talk" would be mapped to the root word "talk".  
Stop Word Removal - words, such as "with" or "is," are eliminated to identify the most important parts of the sentence.

## Text Representation

Bag of words - converting the text into a matrix of word counts without context/meaning  
Word embedding - semantic meanings of words and representing them as numbers, allowing for similar words to have similar representations

## Pre Training

- Next word predictions - supervised learning to generate coherent text by capturing the dependencies between words in the larger context. During training, the model is presented with pairs of input and output examples.
- Masked language modeling - training a model to predict a masked word that is selectively hidden in a sentence.
- Transformer - multiple parts of the sentence simultaneously- ie preprocessing + positional placement + encoders (relationship between words) + Decoders (neural networks of larger concept)

## Fine Tuning

- Zero shot learning - perform a task it has not been explicitly trained on. a child has only seen pictures of horses and is asked to identify a zebra with additional information that it looks like a striped horse.
- Few shot learning - to learn a new task with very few examples. (one shot is one example)
- Multi shot learning - uses the knowledge learned from previous tasks, along with more examples of the new task, to learn and generalize to new tasks - ie. identifying different dog breeds

Prompt Engineering: the art and science of designing and optimizing prompts to guide AI models, particularly LLMs, towards generating the desired responses. lays a vital role in ensuring accurate, relevant, and safe interactions. Think of it as providing a roadmap for the AI, steering it towards the specific output you have in mind.

<https://cloud.google.com/discover/what-is-prompt-engineering#types-of-prompts>

### Fine Tuning vs. RAG

Most organizations currently don't train their own AI models. Instead, they customize pre-trained models to their specific needs, often using RAG or fine-tuning.

Fine-tuning requires adjusting a model's weights, which results in a highly customized model that excels at a specific task. It's a good option for organizations that rely on codebases written in a specialized language, especially if the language isn't well-represented in the model's original training data.

RAG, on the other hand, doesn't require weight adjustment. Instead, it retrieves and gathers information from a variety of data sources to augment a prompt, which results in an AI model generating a more contextually relevant response for the end user.

<https://github.blog/ai-and-ml/generative-ai/what-is-retrieval-augmented-generation-and-what-does-it-do-for-generative-ai/>

### Advanced Fine Tuning

- RLTHF Reinforcement Learning Through Human Feedback: external expert to validate the data and avoid these inaccuracies.

### Fine-tuning vs. Pre-training

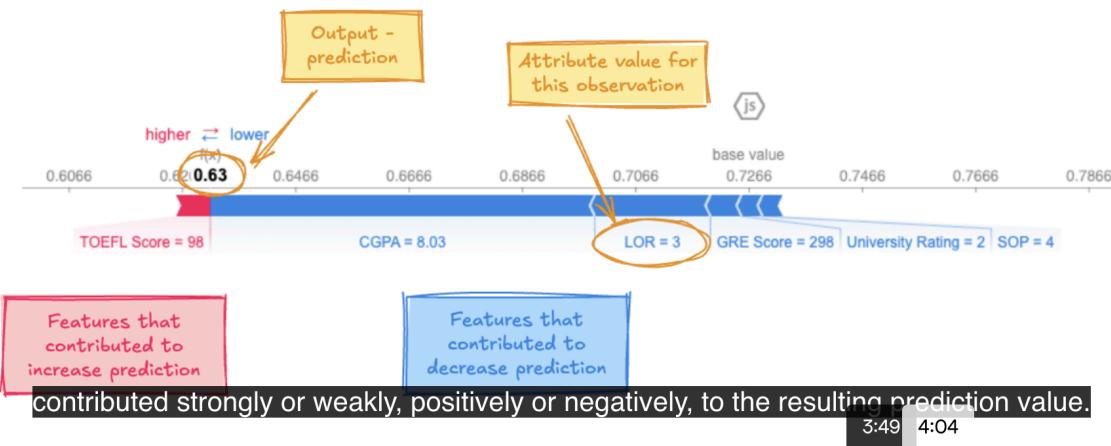
Fine-tuning is more effective since it can help a model learn, or be trained, using a single CPU and GPU, while pre-training may require thousands of CPUs and GPUs to train efficiently. Additionally, fine-tuning can take hours or days, while training a model from scratch may take weeks or months. Furthermore, fine-tuning requires only a small amount of data, typically ranging from a few hundred megabytes to a few gigabytes, compared to hundreds of gigabytes as are necessary for pre-training.

# AI Transparency - XAI

SHAP	LIME	Decision Trees
Highly complex model with difficult to understand decision-making	Extremely precise predictive model, requiring specific explanation for individual predictions	Simple model with a need for clearer understanding of decisions.

## XAI tools: feature importance

SHAP (SHapley Additive exPlanations)

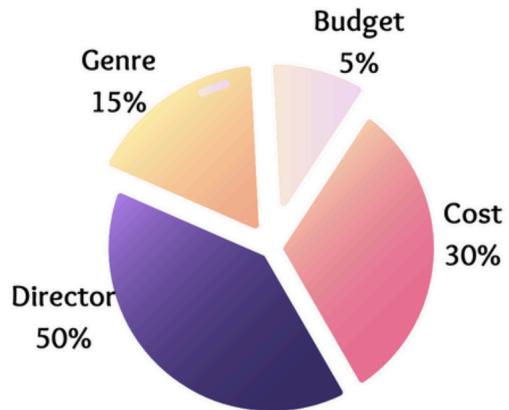


Explainable AI

50 XP

## SHapley Additive exPlanations (SHAP)

- SHAP: A detective of AI, revealing feature importance
- SHAP in Action
  - Director: 50%
  - Cast: 30%
  - Genre: 15%
  - Budget: 5%



prediction, the cast was 30% responsible, the genre was 15% responsible, and the budget was 5% responsible.

## Detection and prevention

### Key usage principles

- Human-in-the-loop
- Harm prevention
- Continuous monitoring

### Points of Detection and Prevention



## Use the right tool for the job

### Discriminative Models

- Predict tomorrow's weather
- Categorize books
- Determine if a picture is a puppy or a bagel

### Generative AI

- Write code for a website
- Answer unique customer service questions
- Draw a picture of a cat scuba diving

### Artificial General Intelligence

- Complete traditionally human jobs

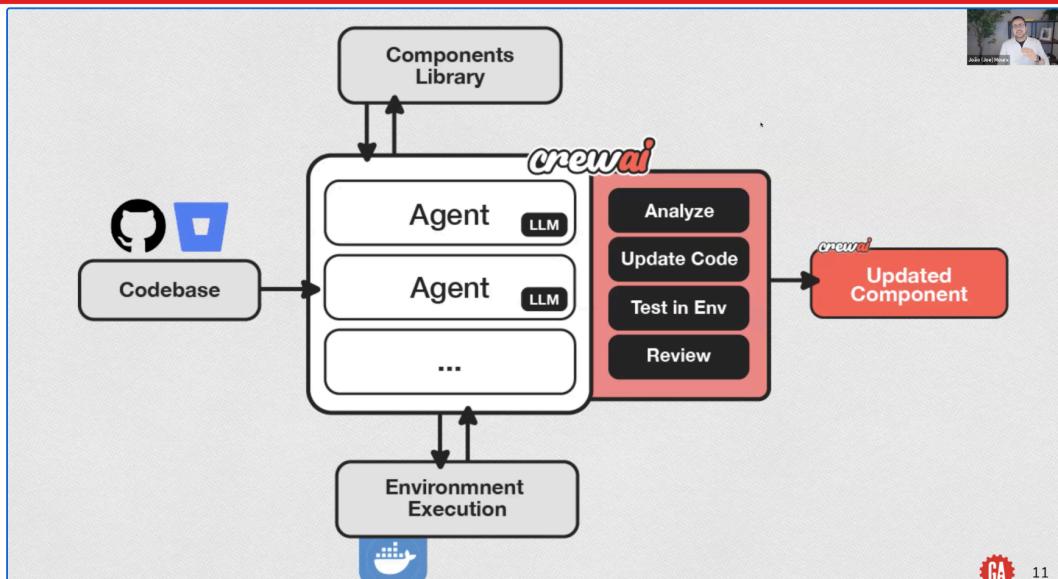
# Agentic AI Example

General Assembly Webinar: Agentic AI:

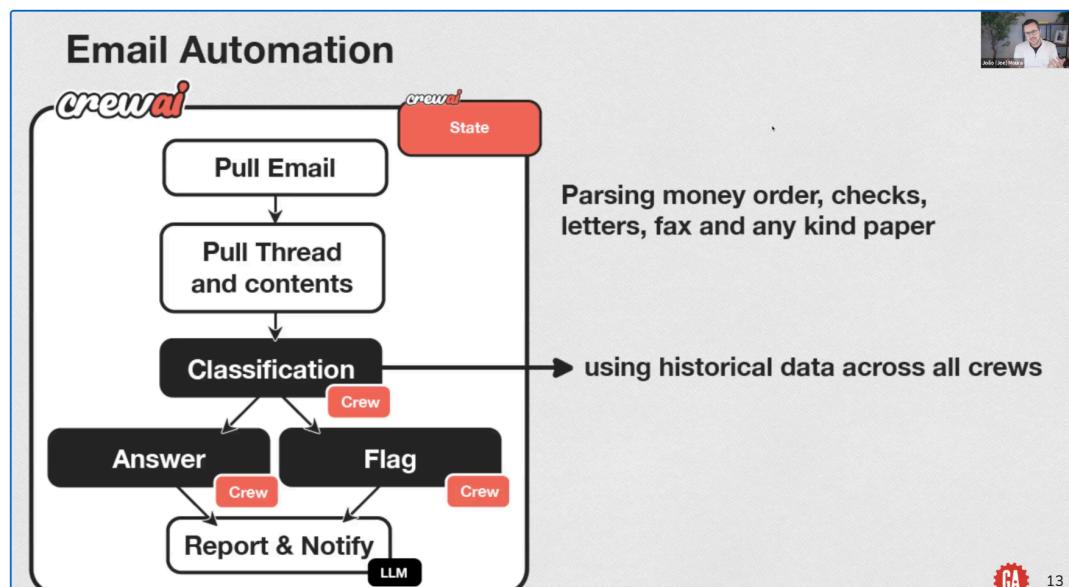
[https://events.zoom.us/ejl/ArlLp35BPGsW4S1zjxFZKVX-c1lwZD9H1DYfwkdmzQEsrVQIRWdH~A4IEtMcJyC3D6WKR-f0dxL121cYDKQe5f-c9BEjof\\_VDDbN511-LqBmuJdXfDHs9g9E-MQJ4\\_plGfdJ1dyRO-nwCfcII/gg6WJbDYZRJ6Z0awiY\\_ibUg/video/wJ8gKUESDqCXYzsm2G5\\_A?dlacc\\_essid=oNOyoGLPSWunaygar7at1A&directLinkOpen=1](https://events.zoom.us/ejl/ArlLp35BPGsW4S1zjxFZKVX-c1lwZD9H1DYfwkdmzQEsrVQIRWdH~A4IEtMcJyC3D6WKR-f0dxL121cYDKQe5f-c9BEjof_VDDbN511-LqBmuJdXfDHs9g9E-MQJ4_plGfdJ1dyRO-nwCfcII/gg6WJbDYZRJ6Z0awiY_ibUg/video/wJ8gKUESDqCXYzsm2G5_A?dlacc_essid=oNOyoGLPSWunaygar7at1A&directLinkOpen=1)

The screenshot shows a Zoom webinar interface. At the top, there's a red header bar with the 'GENERAL ASSEMBLY' logo. In the top right corner, there are video and audio controls. Below the header, the title 'Agentic Systems' is displayed in bold black text. Underneath the title is a flowchart consisting of three rectangular boxes connected by arrows: 'Unclear Data Coming In' → 'Partially Black Box' → 'Expectation of Data Coming Out'. Below the flowchart is a slide with the title 'Deterministic Control on a Probabilistic System'. This slide features five pink rectangular boxes arranged in two rows: 'Memory', 'Flows', and 'Training' in the top row, and 'Guardrails' and 'Prompting Optimization' in the bottom row. At the bottom of the slide is a dark footer bar with a progress bar, a timestamp (00:26:36 / 01:05:37), and other video controls.

The screenshot shows a slide titled 'You Are the Manager, Not the Programmer' in bold black text. Below the title, the text 'Agents = Teammates, not tools' is displayed. The slide lists four steps in colored boxes: Step 1 (yellow) 'Define the goals (business objectives)', Step 2 (green) 'Delegate tasks (assign roles)', Step 3 (blue) 'Organize crews (functional teams)', and Step 4 (red) 'Monitor + iterate (optimize workflows)'. In the bottom right corner of the slide, there's a small circular logo with 'GA' and the number '10'.



GA 11



GA 13

## Making Agents Smarter With Memory

### Types of memory in CrewAI:

**Short-term:** Context of the current task

**Long-term:** Past events or decisions

**Entity:** Information about people, tools, or products

### Why it matters:

Increases relevance

Prevents repetition

Enables coordination