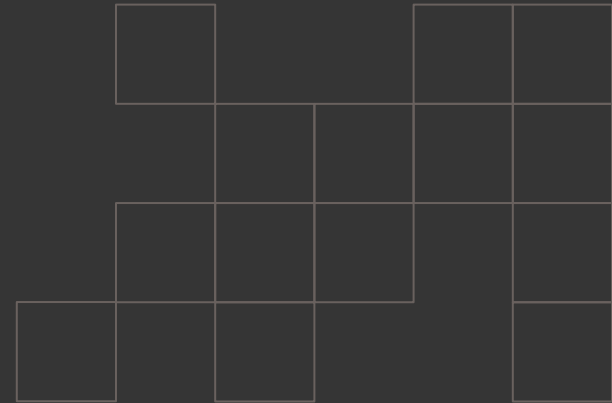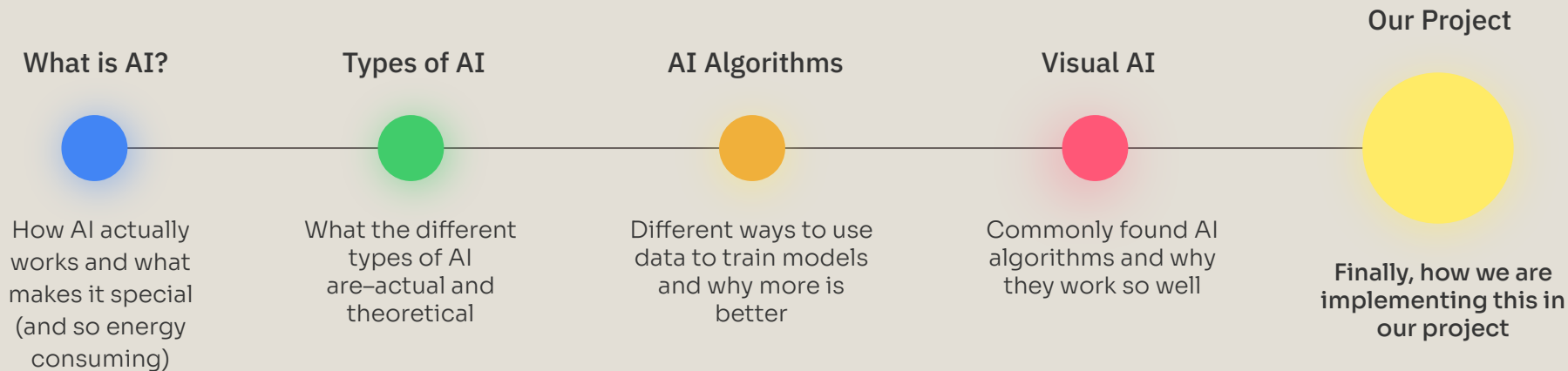ITC 2025
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AI Overview and Terminology

Overview and practical analysis of AI implementation through Python and how to use it in an animatronic

Contents

What is AI?

How AI actually works and what makes it special (and so energy consuming)

Types of AI

What the different types of AI are–actual and theoretical

AI Algorithms

Different ways to use data to train models and why more is better

Visual AI

Commonly found AI algorithms and why they work so well

Our Project

Finally, how we are implementing this in our project

What is AI?

AI is an type of programming which allows a program to draw conclusions from patterns and change outputs based on new data without programmer intervention.

Basically, highly advanced pattern recognition and generation accordingly.

Data Curation

A large data set is given attributes to give a model examples of what is or isn't whatever is being recognized

Model Selection

Different models are better for different tasks, covered next

Model Training

The model is fed the curated data to allow it to learn patterns and form prediction patterns

Testing/Validation

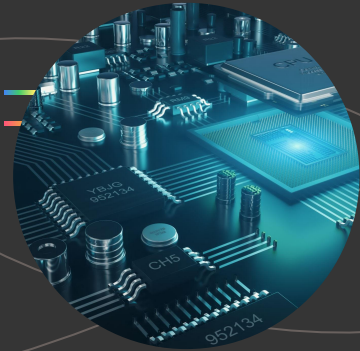The model's performance is evaluated using new, unseen data

Model Refinement

Model is monitored, adjusted, and given more cleaned data to remedy deviations
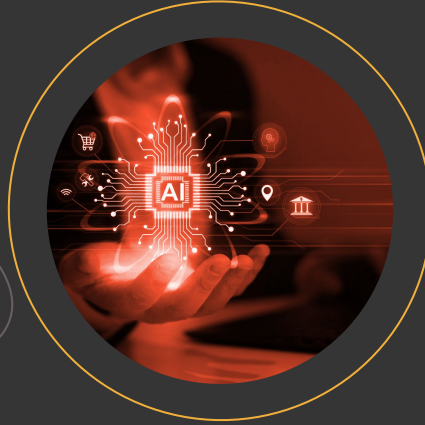
Model Deployment

The model is ready for use with minimal oversight and deviation

https://www.oracle.com/in/artificial-intelligence/ai-model-training/

Types of AI

Artificial Narrow AI
Weak AI

This is the only type of AI which exists today. Can be trained to perform a single task and can work faster than a human mind for some.


General AI (AGI)
Strong AI

Currently theoretical, but in concept would be able to think, reason, and make judgement.

Artificial Superintelligence
Super AI

Much like AGI, but would be able to be smarter than human and have judgement which surpasses emotion.

https://www.ibm.com/think/topics/artificial-intelligence-types

Most AI models fall under one of these two categories
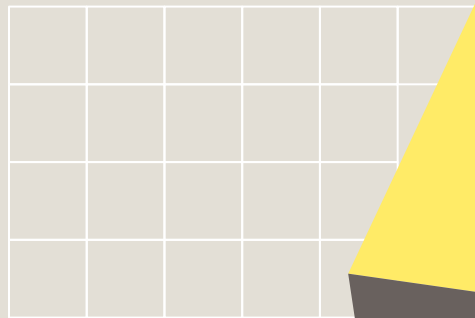
Generative

Create/generate new content

Think ChatGPT.

Predictive

Analyze data to make predictions and decisions.

Think cancer recognition AI technology.

Types of AI Models

Machine Learning

Machine learning is the type of AI most commonly used.

Classification: Either/or result using binary (1 or 0). There is also **multi-class classification.**

Regression: Result will end with a **real number** (round or decimal point. Usually uses dependent and independent variable.

Supervised Learning

Model takes **clearly labeled** data during training.

Decision trees: Data is organized in a tree structure, where "roots" are training datasets and new data is input as a node in its corresponding location using **Attribute Selection Measures (ASM)** as defined by the program

Unsupervised Learning

Model takes **unlabeled data** during training and evaluates to provide more insights on relationships.

Clustering: Sorting unlabeled data points into predefined clusters. Goal is to have each point belong to one cluster with no overlap
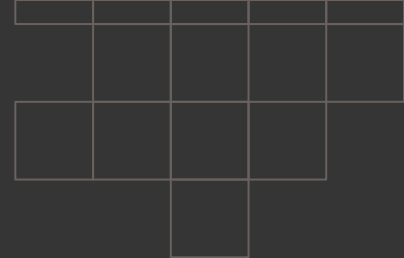
Reinforcement Learning

Model learns by taking in feedback from the result of its action. Uses an **agent to perform actions** and an **environment** where the action is performed. The environment sends the agent **positive or negative rewards** to either promote or discourage behavior and model adjusts accordingly.

Deep Learning

Advanced type of ML that learns to identify complex patterns in text, images and sounds. Data is **processed and classified** through the **input layer**, which receives and passes raw data, **hidden layers** which assess and transform, and **outer layer** which uses processed data to deliver a result.

https://www.mendix.com/blog/what-are-the-different-types-of-ai-models
https://www.tableau.com/data-insights/ai/algorithms

AI Algorithms

Commonly used algorithms

Random Forest: A collection of decision trees. Different decision trees are built and connected to get more accurate results.

Support Vector Machine (SVM): Can be used for either classification or regression. Plots each data point into a chart of N dimensional space where N= # of datapoints. Then, the algorithm classifies data points by finding hyperplane separating each class.

Linear and Logistic Regression: These two are supervised learning algorithms which discover the relationships between data points, whether numerical (linear) or binary (logistic)

K-means clustering: Designed to perform clustering in unsupervised learning by taking in predetermined clusters and plots all data regardless of cluster. Then, it plots a randomly-selected piece of data as the **centroid** of each cluster. From there, it sorts remaining data points into clusters based on proximity to each other and the centroid data point for each cluster.

Neural Networks: A collection of AI algorithms which mimic functions of the human brain, especially used for classification and pattern recognition. The most cited is a **convolutional neural network (CNN)**, which focuses on processing grid-type data (like images and videos) using convolutional layers filtering driving patterns and spatial hierarchies.

      Convolutional operations: Specialized linear operation which detects local features of an image by applying filters.

https://www.tableau.com/data-insights/ai/algorithms
https://www.geeksforgeeks.org/types-of-neural-networks/

Visual AI

Technical Components

1 | **Image Processing**
Preprocessing steps include noise reduction, normalization, and enhancement through filtering, edge detection, and histogram equalization to improve quality and highlight important features.

2 | **Feature Extraction**
Identifying and extracting relevant features from processed images. Features means edges, textures, colors, shapes, and patterns. Often uses CNNs to learn and extract features.

3 | **Object Detection and Recognition**
Detect and recognize objects. Algorithms such as You Only Look Once (YOLO), Single Shot MultiBox Detector (SSD), or Faster R-CNN.

4 | **Image Segmentation**
Divide image into segments/regions to simplify analysis. Can be semantic (each pixel has a class) or instance-based (differentiate between objects)

5 | **Deep Learning Models**
CNNs and Generative Adversarial Networks (GANs) are trained on mvast datasets to learn intricate patterns and perform tasks such as image classification, anomaly detection, and style transfer.

6 | **3D Reconstruction**
Techniques like Structure from Motion (SfM) and multi-view stereo create 3D models from 2D images by enabling detailed spatial analysis.

https://www.constructionindustryai.com/articles/understanding-visual-ai-technical-overview

More AI Algorithms

| Algorithm Name	Functionality
You Only Look Once (YOLO)	20+ layer deep CNN and single shot object detection, which allows for $O(n)$ time efficiency.
Single Shot MultiBox Detector (SSD)	Uses a single convolutional neural network (CNN) to predict bounding boxes and class probabilities for objects within an image.
Faster R-CNN	Uses two-stage object detection.
Generative Adversarial Networks (GAN)	Trains two neural networks to compete against each other to produce more accurate results.

https://www.v7labs.com/blog/yolo-object-detection

What are we doing?

We are using an AI to process audio and convert to a transcript, then feeding that to a language processing model which will tell our animatronic what to do.

This means we're using two types of AI, and two models to accomplish it.

Data inputs and outputs will be passed from one model to another then to the animatronic using Python scripts.
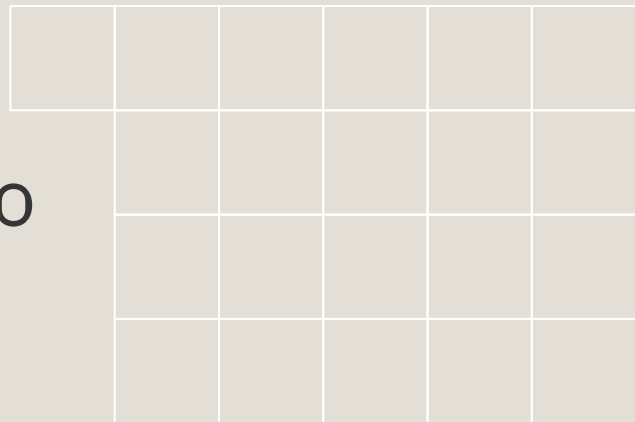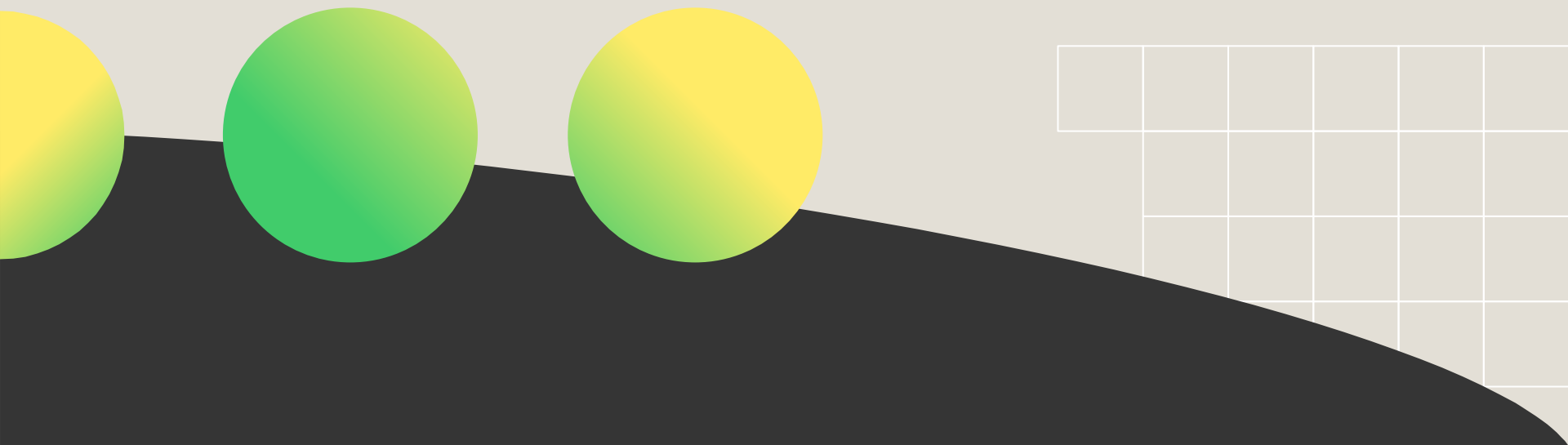
The solution

AI Models

One model we are looking at is WhisperAI, which can transcribe audio.

To make sense of the transcript, we are using a modified lite version of DeepSeek, an open source AI model.

Software to Hardware

To communicate with the model, which uses Bottango software, we are implementing a Python script which uses **API keys**

Terms to Know Before You Go

JSON

Javascript object notation

This is a format that converts objects in code to **strings** (text) to pass information from one code to another or across the internet.

API/API Key

Application Programming Interface

An API is in simple terms a form of database that stores data to be retrieved only if the client requesting the data provides the correct API Key. This is a way to securely pass information.

November 2026