Experience AI

Year 8 Artificial Intelligence & Machine Learning

8.2 • Knowledge Organiser

AI Concepts & Definitions

- **Artificial Intelligence:** Computer systems that can perform tasks typically requiring human intelligence
- **Machine Learning:** Subset of AI that learns patterns from data without explicit programming
- **Rule-based Systems:** Traditional programming using if-then statements and fixed rules
- **Data-driven Approach:** Systems that learn from examples and improve with experience
- **Pattern Recognition:** AI's ability to identify regularities in data

🔄 **Key Difference:** Traditional programs follow rules; AI systems learn from data to make predictions.

Machine Learning Types

Supervised Learning
Learns from labelled examples (input-output pairs)

Unsupervised Learning
Finds hidden patterns in unlabelled data

Reinforcement Learning
Learns through trial and error with rewards

Classification
Supervised learning that predicts categories

- **Examples:** Email spam detection (supervised), customer grouping (unsupervised), game playing (reinforcement)
- **Applications:** Image recognition, recommendation systems, autonomous vehicles

Training Data & Classification

- **Training Data:** Labelled examples used to teach ML models
- **Features:** Input characteristics for predictions (colour, size, shape)
- **Labels:** Correct answers provided by humans
- **Data Quality:** Diverse, accurate data = better performance
- **Classification:** Predicting which category something belongs to
- **Confidence Score:** How certain the model is (0-100%)

📈 **Key Rule:** Good training data = Good AI model!

Bias & Ethics in AI

- **Data Bias:** Training data that doesn't represent all groups fairly
- **Societal Bias:** Unfair treatment reflected in AI systems from human prejudices
- **Algorithmic Bias:** Unfair outcomes that disadvantage certain groups
- **Fairness:** Ensuring AI treats all people equitably regardless of background
- **Transparency:** Being able to understand and explain AI decisions
- **Accountability:** Taking responsibility for AI system outcomes

⚠️ **Critical:** AI systems can perpetuate or amplify existing societal inequalities if not carefully designed.

Decision Trees & Explainability

- **Decision Tree:** Model that asks yes/no questions to classify
- **Root Node:** Starting point with most important feature
- **Leaf Nodes:** End points with final classification
- **Branches:** Paths through tree based on feature values
- **Explainable AI:** AI decisions humans can understand
- **Feature Importance:** How much each input affects decisions

```
Size > 5cm? → Yes: Red? → No: Apple
→ Yes: Round? → Yes: Cherry
```

AI Project Lifecycle

- **1. Problem Definition:** Clearly identify what you want the AI to solve
- **2. Data Collection:** Gather relevant, high-quality training examples
- **3. Data Labelling:** Add correct answers to training examples
- **4. Model Training:** Use algorithm to learn patterns from data
- **5. Testing & Evaluation:** Check how well the model performs on new data
- **6. Deployment:** Put the working model into real-world use
- **7. Monitoring:** Continuously check performance and update if needed

🔧 **Iterative Process:** AI development involves multiple cycles of improvement and refinement.

Model Evaluation & Testing

- **Accuracy:** Percentage of correct predictions (e.g., 85%)
- **Test Data:** New examples not used in training
- **Confusion Matrix:** Table showing correct vs incorrect predictions
- **Overfitting:** Works on training data but fails on new data
- **Validation:** Checking model performance on unseen data
- **Model Card:** Document explaining model limitations

```
Accuracy = Correct / Total × 100
Example: 85/100 × 100 = 85%
```

AI Applications & Careers

- **Data Scientist:** Analyses data to find patterns and insights
- **Machine Learning Engineer:** Builds and deploys AI systems
- **AI Ethics Specialist:** Ensures AI systems are fair and responsible
- **Research Scientist:** Develops new AI algorithms and methods
- **Product Manager:** Oversees AI product development and strategy
- **Applications:** Healthcare diagnosis, autonomous vehicles, smart assistants, fraud detection

🚀 **Future Skills:** AI will transform most careers - understanding AI fundamentals is increasingly valuable!