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| **Lesson Title** |
| Lesson 1 – AI Midge Project – Train, Test and Compare AI Image Models  |
| **Introduction** (Including Background/Lesson Rationale) |
| In this lesson, students will train AI models to **recognise and classify images using supervised learning**.Delivery over multiple periods of learning may be advisable.**This lesson is designed for Computing Science students, S4 to S6 to support learning and teaching of AI concepts and practical skills for learners undertaking SQA Artificial Intelligence Unit(s) (Level 4 - J8E0 44, Level 5 - J8E0 45, Level 6 - J8E0 46).** |
| **Materials required** |
| **Slides:** 1) AI Midge Project – Train, Test and Compare AI Image Models**Handouts:** *(NB designed to be printed black and white to save printing costs)*biting midge.pdf (1 copy per pair/group)non-biting midge.pdf (1 copy per pair/group)test-midge – large.pdf (1 copy per pair/group)Test Plan for AI Model Template (digital (.docx) or paper-based)**Paper & Pencils** (to sketch decision tree)**Online Tools:**Google Teachable Machine (<https://teachablemachine.withgoogle.com/>)(if blocked, try GenAI Teachable Machine <https://tm.gen-ai.fi/image/general>)Machine Learning for Kids (<https://machinelearningforkids.co.uk/>) * This project does not require you to create an account or log in. For this project, the examples you use to make the model are only stored temporarily in your browser (only on your machine).

**Digital Copies of Midge Images:** *(via local shared drive or hosted in GDrive)* biting midge (1-16.png)non-biting midge (1-16.png)test midge (1-4.png)**Teacher Laptop/PC with webcam** (at least 1)**Student Laptops/PCs** (1 per pair/group) |
| **Learning Intentions/Success Criteria** |
| 1. **Understand the Basics of AI and Machine Learning**:
	* Students will learn that artificial intelligence (AI) and machine learning (ML) can be used in real-world applications.
2. **Introduction to Supervised Learning**:
	* Students will understand the concept of supervised learning, where models are trained using labelled data.
3. **Image Recognition and Classification**:
	* Students will learn how AI models can be trained to recognise and classify images by learning from labelled examples.
4. **Data Collection and Labelling**:
	* Students will explore the importance of collecting and labelling data accurately for training AI models.
5. **Training the Model**:
	* Students will learn the steps involved in training an AI model, including feeding it labelled images and adjusting the model based on its performance.
6. **Evaluating Model Performance**:
	* Students will understand how to test and evaluate the performance of an AI model.
7. **Hands-On Practice**:
	* Students will get hands-on experience by working with a simple AI model to classify images, reinforcing their understanding of the concepts.
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| **Curriculum Links** |
| SQA Artificial Intelligence Unit(s) (Level 4 - J8E0 44, Level 5 - J8E0 45, Level 6 - J8E0 46) |

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| **Lesson Outline** |
| 5 mins | **Starter Activity:** Image Recognition (Human Brain)**1) Picture reveal (Slides 2 & 3)**Click on coloured squares to reveal part of the image underneath.How **sure** are students after, 2, 4, 6 squares have been removed? Class discussion opportunity around ‘**Certainty Factor**’.*(NB If students won’t recognise Andy Murray swap image or create additional slides with famous people, places, objects etc)* **2) Scene Understanding (Slides 4 & 5)**What are we looking at?How many horses?Class discussion opportunity around **edge detection**, **pattern recognition**, **image understanding**  |
| 10 mins | **Intro to Midge Project (Slides 6 & 7)**STV News video “A Cloud of Pain” (2m 09s)**Breaking News Non-Biting Midge (Slide 8)**\*\*Issue handouts\*\*biting midge.pdf (1 copy per pair/group)non-biting midge.pdf (1 copy per pair/group)Allow students time to discuss features of biting v non-bitingDiscussion around training data and working with labelled data sets.**What’s your hypothesis? (Slides 9 to 14)** |
| 10 mins | **Decision Trees (Slides 15 to 23)**\*\*Issue Paper & Pencils\*\*If students are familiar with decision trees, they may be able to create their own.If students are new to decision trees they can be coached through slides to draw their own decision tree.NB Retain decision tree to help with lesson 2. |
| 10 mins | **Test Hypothesis (Slide 24)**\*\*Issue handout\*\*test midge.pdf (1 copy per pair/group)In pairs/groups students should aim to identify whether test midges 1, 2, 3, 4 are biting or non-biting. (Use decision tree to assist).Solutions can be discussed in turn using **slides 25 to 29**. |
| 20 mins | **Train and Test an AI Image Model****1) Teachable Machine** Google Teachable Machine (<https://teachablemachine.withgoogle.com/>)(if blocked, try GenAI Teachable Machine <https://tm.gen-ai.fi/image/general>)*NB If students have not used TM before a separate lesson may be advisable to introduce this AI tool.*\*\*Issue Test Plan for AI Model Template\*\* Digital or Paper-based**Teacher-led Demo of Teachable Machine**Teacher-led demo/recap of teachable machine trained to identify between two or more categories of object (toys/fruits etc).Teacher-led tutorial to set up model, locate image files, train and test model.+ New Project+ Image Project+ Standard Image Model+ Class 1: Biting Midge+ Class 2: Non-biting Midge+ Upload 16 training images into each training set+ Train Model+ Test the model using supplied Test images (1-4.png)Students complete Test Plan for AI Model Template (digital (.docx) or paper-based)Use exemplar **(slide 33)** as a guide |
| 20+ mins | **Train and Test and Compare an AI Image Model****2) Machine Learning for Kids Scratch Project** Machine Learning for Kids (<https://machinelearningforkids.co.uk/>) *NB If students have not used ML for Kids before separate lessons may be advisable to introduce this AI tool.*\*\*Issue ML for Kids - Midge Project Recognising Images.pdf\*\***Students follow tutorial instructions to create ML Scratch Project****(Note that tutorial format follows other ML4Kids tutorial templates for familiarity)**Students complete Test Plan for AI Model Template (digital (.docx) or paper-based) to help evaluate and compare their AI Image recognition models. Use exemplar **(slide 36)** as a guide |
| 5 mins | **Closing Discussion:** **(Slide 37)**Plenary/Summary of learning across lesson (periods)Human brain helps us identify and classify objects almost instantly.AI models can be trained using supervised learning to recognise and classify imagesWhich model was better TM (or GenAI) vs ML4Kids?Real-world application of AI e.g. Midges impact on Scottish tourism.Decision trees can be used to classify data, predict outcomes, and assist in decision-making processes.(NB retain decision trees for lesson 2) |

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| **References/Notes (optional!)** |
| SQA Artificial Intelligence Units Level 4 - J8E0 44, Level 5 - J8E0 45, Level 6 - J8E0 46Outcome 4 – students will acquire the skills required to develop their own AI systems.Students will be able to:* Apply a model to solve a problem
* Prepare training data for the model
* Use the model to solve a defined problem
* Develop and execute test plans for the model
* Identify improvements and modify the model
* Compare and evaluate the models

<https://www.sqa.org.uk/files/nq/J8E044.pdf><https://www.sqa.org.uk/files/nq/J8E045.pdf><https://www.sqa.org.uk/files/nq/J8E046.pdf> |