**Lesson Primer - What is machine learning?**

1. **What you need to know about running this lesson**

**Practical issues**

For the first half of this course students work individually to explore different aspects of machine learning and the ethics issues raised. In the second half of the course students can work individually or in teams to design and a build a machine learning model prototype using the online tool <https://machinelearningforkids.co.uk/>. The previous version of this course used ML4K for visual, text and number based models. However free visual recognition API keys have proved difficult to obtain so this year we are using Cognimates for whole class visual recognition activities. If students wish to build a visual recognition model prototype it is recommend that they use ML4K tool as it is easier to build a user interface with this tool.

**Cognimates**

Cognimates <http://cognimates.me/home/> is an online tool for creating machine learning models. There are step by step instructions on how to use the tool on the presentation. Students require an email address to create an API key. If this is not possible the activity can be done as a demo by the teacher.

**Technical issues**

The following online tool is used in this session. The user is asked to draw a number of different pictures and the computer tries to guess what is being drawn (by comparing it to previous input from users.

<https://quickdraw.withgoogle.com/>

**Activity timings and degree of difficulty**

| **Activity** | **Timing** | **Degree of difficulty**  **(out of 5\*)** |
| --- | --- | --- |
| **1.1 Introduction - What is machine learning**  Students brainstorm what they already know about machine learning. They then watch the video and answer the remaining questions on worksheet 1.1 | 15 mins | \*\* |
| **1.2 How do machines learn -** Students use Quick, Draw to explore how the tool is able to guess what they have drawn based on the input from previous users. (optional 1 min 40s video explains how it works) | 10 mins | \* |
| **1.3 - Cat or dog -** students try to formulate rules to identify images of cats and dogs. | 10 mins | \*\* |
| **1.4 - Building a model in Cognimates**  Students use Cognimates to build a model to identify cats and dogs | 10-15 mins | \*\*\* |
| **1.4 - Neural networks** - students watch video then answer questions on worksheet 1.4 | 10-15 mins | \*\*\* |
| **1.5 – Homework / Extension -** Video on how machine learning sometimes produces unexpected results |  | \*\* |

1. **Key information and terminology you’ll need**

**Artificial intelligence** - computer systems that are able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

**Big data** - extremely large data sets that may be analysed using computers to reveal patterns, trends, and associations, especially relating to human behaviour and interactions.

**Machine learning** - a field of computer science that gives computers the ability to learn without being explicitly programmed.

**Supervised learning** - input data (called ‘training data’) is given a known label or result such as spam/not-spam or a stock price at a time. A model is prepared through a training process in which it is required to make predictions and is corrected when those predictions are wrong. The training process continues until the model achieves a desired level of accuracy on the training data.

**Unsupervised learning** - input data is not labelled and does not have a known result. A model is prepared by deducing structures present in the input data. This may be to extract general rules. It may be through a mathematical process to systematically reduce redundancy, or it may be to organise data by similarity.

**Neural networks** - **Neural networks** are modelled loosely on the human brain and enable computers to learn from being fed data. The typical neural network consists of thousands of interconnected artificial **neurons**, which are stacked in rows that are known as **layers**, forming millions of connections.

1. **Assessment questions**

* Knowledge – What is machine learning?
* Comprehension – What is the difference between AI and machine learning?
* Application – Give some examples of machine learning being used in day-to-day life.
* Analysis – Why is the use of machine learning increasing rapidly?
* Synthesis – What potential future uses of machine learning can you think of?
* Evaluation – What might be the dangers of using machine learning?

1. **Further reading to help you get to know the topic**

This is an excellent blog on teaching machine learning by Dale Lane who developed the machinelearningforkids tool:

<http://dalelane.co.uk/blog/?p=3513>