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# Title: Artificial Intelligence Course Overview

**Summary:** This document provides an overview of the lessons in the Digital Technologies Institute's course on Artificial Intelligence, available at https://mycomputerbrain.net/php/courses/ai.php

**Year Levels**: 5-6, 7-8, 9-10

**Key Terms:**

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| AI | Artificial Intelligence |
| ML | Machine Learning |
| ANN | Artificial Neural Network |

**Purpose of the course**

The purpose of the course is to introduce students to artificial intelligence, its key concepts and application in day to day activities. The course is also intended to help students reflect on their own learning and help them to become more effective learners.

**Accompanying course materials:**

Video Webinar Recording: https://www.youtube.com/watch?v=7pNxYNYz-8o

## Lesson overview

| Lesson # | Title | Synopsis |
|---|---|---|
| 1 | Getting started | Students explore an artificial neural network and learn about key terms and their biological counterparts:<br>- perceptrons / neurons<br>- synapses connecting perceptrons<br>Students explore the arrangement of perceptrons and synapses to form a simple brain that takes input from the eye and interprets the information to decide what the eye sees. Students understand that an ANN needs to be trained through a learning process before it can be used. |
| 2 | The benefits of neural networks | Students learn that ANNs are very good at recognising shapes, even if they significantly differ from the shapes the ANNs have learned. Students explore this through a 7x5 pixel matrix in which they modify letters and observe the output of the ANN. |

| Lesson # | Title | Synopsis |
|---|---|---|
| 3 | Variety, variety | Students learn that ANNs get better if they are exposed to input data that varies. Two different shapes of the letters A…J are fed into the ANN and this improves the ANN's ability to recognise similar shapes. The learnings from this lessons are applied to the student's own learnings. |
| 4 | Numbers | Up to this point in the course, students have worked with just letters. In this lesson, students explore if ANNs can also deal with numbers. Students learn ofd the general purpose nature of ANNs. |
| 5 | Mixing letters and Numbers | Continuing from the previous lesson 4, we are starting to mix letters and numbers to further emphasise that ANNs can deal with a variety of inputs, even if they are unrelated. In this lesson, we mix capital and lower case letters and numbers. Students are encouraged that their human brains are very capable to learn all sorts of information. e.g. different subjects. Teachers are encouraged to emphasise this point, helping students to understand that their brains are very capable. |
| 6 | How do we learn best? Part 1 | This is the first part of an experiment that explores learning strategies and forgetfulness. At the end of this experiment, students have learned that they can forget knowledge if they don't perform regular revision. |
| 7 | How do we learn best? Part 2 | This second part of the experiment demonstrates the power of revision. Students understand that though revision requires effort, the learning outcomes are so much better. Especially under the ATAR system where students have to remember things for longer, revision needs to be practiced early and regularly. At the end of the lesson, one learning technique is introduced that helps with revision, the Leitner system. |
| 8 | Emotions | Continuing from letters and numbers, students explore face recognition through emojis. A simple ANN is trained to recognise four different emojis. Students modify individual pixels and observe how the system reacts. Students learn of the different facial features that are analysed for a reliable face recognition system. |

| Lesson # | Title | Synopsis |
|---|---|---|
| 9 | An AI number converter | To this point, students have explored pattern recognition with AI. This experiment enters a computational process to convert decimal numbers into binary. Students learn that recognising an image is very similar to converting it into another representation, such as binary. At the same time, students learn a bit about binary numbers. |
| 10 | Investigating the hidden layer | In this experiment, students explore the inner workings of an ANN and determine the influence of the number of perceptrons in the hidden layer on the learning outcomes of the ANN. Students download a worksheet and conduct various experiments that measure the training time and plot it against the number if hidden layer perceptron. This lesson touches on data collection and interpretation (ACTDIP016/25/26). Students learn that a larger hidden layer is slower, but can lead to more reliable learning outcomes. |
| 11 | Alphabet | With an increased hidden layer, students embark on their ANN learning the entire alphabet. This is the largest number of concurrent patters in this course so far. Again, the point is made that ANNs are general purpose machines that can deal with all sorts of patterns. |
| 12 | Inside the perceptron | In this and the following experiment, students explore the inner workings of a neural network and a perceptron. A new functionality is introduced that allows students to look into a perceptron by hovering their mouse course over it. Students learn about input, out put and the activation function. Students see the connection to mathematics. |
| 13 | Let's be a perceptron | This experiment focuses on a single perceptron. Students perform the role of this perceptron by performing multiplication ion the input and weight values. |
| 14 | Home Automation with AI | This end the following four experiments apply AI to various scenarios. In this experiment, students a simple home automation system that turns the lights and the fan on and off on their command |
| 15 | Personalised Home Automation with AI | This experiment is a generalisation of the previous one. It is a home automation system that can do any four different things at. Students enter the input and output patterns and observe how the ANN is constructed in real-time. |

| Lesson # | Title | Synopsis |
|---|---|---|
| 16 | An AI Librarian | Students explore an automatic librarian that can classify books for students of different year levels, based on certain book characteristics. |
| 17 | Anti-bullying AI | Bullying is a big issue for students. In this lesson, students explore how an AI can be a helping hand to avoid singing SM messages that can be offensive. Students train the ANN with kind and mean terms. The setup of this experiment is similar to the 'Personalised Home Automation with AI' lesson |
| 18 | AI Scientist | Based on a real-life year 11 chemistry experiment, students apply ante ANN to the analysis of data to find a curve that best fits the data. |
| 19 | Data Bias in AI | Ai has been criticised for sometimes exhibiting data towards gender, ethnicity, etc. In this lesson, students explore how the selection of training data can lead to data bias in an AI. |
| 20 | Solving data bias | Following on from the previous experiment, students address the issue of data bias by providing a more balanced training data set to the AI. |
| 21 | AI Tracing | In this experiment, students explore the data flow with an ANN. For this purpose, the ANN is simplified to just 9 perceptrons. Student export the ANN to an Excel spreadsheet and then trace the information flow within the network. This activity relates to computer networks, algorithms and data representation |
| 22 | Is it AI? | Based on a model originally proposed by the MIT Technology Review. We use our ANN to tell us if a system that students might encounter in their lives is actually an AI. In the process, students learn about the characteristics of different types of AI, such as computer vision, natural language processing, smart robots, and machine learning. |

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# Australian Curriculum Alignment

## Technologies – Digital Technologies

**Years 5-6**

Examine the main components of common digital systems and how they may connect together to form networks to transmit data (ACTDIK014)

Examine how whole numbers are used to represent all data in digital systems (ACTDIK015)

Define problems in terms of data and functional requirements drawing on previously solved problems (ACTDIP017)

Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration (repetition) (ACTDIP019)

Explain how student solutions and existing information systems are sustainable and meet current and future local community needs (ACTDIP021)

**Years 7-8**

Investigate how data is transmitted and secured in wired, wireless and mobile networks, and how the specifications affect performance (ACTDIK023)

Investigate how digital systems represent text, image and audio data in binary (ACTDIK024)

Define and decompose real- world problems taking into account functional requirements and economic, environmental, social, technical and usability constraints (ACTDIP027)

Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors (ACTDIP029)

Evaluate how student solutions and existing information systems meet needs, are innovative, and take account of future risks and sustainability (ACTDIP031)

**Years 9-10**

Investigate the role of hardware and software in managing, controlling and securing the movement of and access to data in networked digital systems (ACTDIK034)

Analyse simple compression of data and how **content data are separated from presentation** (ACTDIK035)

Analyse and visualise data to create information and address complex problems, and model processes, entities and their relationships using structured data (ACTDIP037)

Design algorithms represented diagrammatically and in structured English and validate algorithms and programs through tracing and test cases (ACTDIP040)

Evaluate critically how student solutions and existing information systems and policies, take account of future risks and sustainability and provide opportunities for innovation and enterprise (ACTDIP042)

## English

*English focus: Bias* occurs in text where a composer presents one perspective, favouring one side in an argument or discussion, often accompanied by a refusal to consider possible merits of alternative points of view.

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| **Years 5-6** | Language: Language for interaction | Understand the uses of objective and subjective language and bias (ACELA1517) |
| **Years 7-8** | Language: Expressing and developing ideas | Analyse how point of view is generated in visual texts by means of choices, for example gaze, angle and social distance (ACELA1764) |

## Health and Physical Education

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| **Years 7-8** | **Contributing to healthy and active communities** | Evaluate health information and communicate their own and others' health concerns (ACPPS076)<br>- analysing the credibility of health messages conveyed by different sources in terms of bias, reliability and validity and applying credible information to health-related decisions |

## ICT Capability[1]

Typically, by the end of Year 6, students:

### Identify the impacts of ICT in society

Explain the main uses of ICT at school, home and in the local community, and recognise its potential positive and negative impacts on their lives

### Select and evaluate data and information

Assess the suitability of data or information using a range of appropriate given criteria.

Typically, by the end of Year 8, students:

### Select and evaluate data and information

Assess the suitability of data or information using appropriate own criteria.

### Identify the impacts of ICT in society

Explain the benefits and risks of the use of ICT for particular people in work and home environments

[1] https://www.australiancurriculum.edu.au/media/1074/general-capabilities-information-and-communication-ict-capability-learning-continuum.pdf