### While we wait to get started ...

Open the chat





Your mic is on mute ... and camera disbaled

Tell us what you want to get out of the session.

#### NOTE:

your name will appear with your comment.

The chat won't be part of the recorded version.



# Discovering Artificial Intelligence (AI)

AI and conventional programming





ESA acknowledges the Eastern Kulin Nation, Traditional Custodians of the land on which our head office stands, and pays our respects to Elders past and present.

We recognise the Traditional Custodians of Country across Australia and their continuing connection and contribution to lands, waters, communities and learning

# By the end of this session

Guide students in how machine learning differs from traditional code, especially in terms of **input data**.

Observe / try a hands-on example of writing a conventional program and adding **AI decisions** to it.

Look at **assessment** and **coding pedagogies**, as well as considerations around **IP** and **privacy**.

### **Achievement standards:**

#### Achievement Standard

By the end of Year 6, students expla digital system components (hardwa and how digital systems are conner explain how digital systems use wh

Students define problems in terms requirements and design solutions needs and consider sustainability creation and communication of id collaborative digital projects using protocols.

#### **Achievement Standard**

By the end of Year 8, students distingu types of networks and defined purpos representing a variety of data types image and audio data can be represe presented in digital systems.

Students plan and manage digital pro address the problems. They incorr information. They define and decomp repetition and user interface desig functional requirements and constrain implement their digital solutions, if experiences and algorithms incorpor They explain how information sys iterations, and test, modify and imple They evaluate information systems of meeting needs, innovation and su and evaluate data from a range of se solutions. They use appropriate prot and collaborating online.

#### **Achievement Standard**

By the end of Year 10, students explain the control and management of networked digital systems and the security implications of the interaction between hardware, software and users. They explain simple data compression, and why content data are separated from presentation.

Students plan and manage digital projects using an iterative approach. They define and decompose complex problems in terms of functional and non-functional requirements. Students design and evaluate user experiences and algorithms. They design and implement modular programs, including an objectoriented program, using algorithms and data structures involving modular functions that reflect the relationships of realworld data and data entities. They take account of privacy and security requirements when selecting and validating data. Students test and predict results and implement digital solutions. They evaluate information systems and their solutions in terms of risk, sustainability and potential for innovation and enterprise. They share and collaborate online, establishing protocols for the use, transmission and maintenance of data and projects.

IES





#### Al topics

# Foci for this deep dive:

Digital Data systems representation Defining and decomposing problems Algorithms Impact of and coding technologies Plan, create and communicate ideas and information



# Artificial Intelligence and conventional programming

Differences and opportunities

**EXPLAINER VIDEO:** Introduction to AI and machine learning



# **Traditional programming**





# Machine learning: training



#### Do this with 100s of known shark images...

Image CC-BY Hermanus Backpackers (Wikimedia Commons)

# Machine learning: training



### Do this with 100s of known dolphin images...

Image CC-BY Charlton-Robb K, Gershwin LA, Thompson R, Austin J, Owen K, McKechnie S. (Wikimedia Commons)

# Machine learning: testing



Image CC-BY Albert kok (Wikimedia Commons)



### What do you notice about the input data...

...in traditional programming?

discrete, quantifiable

...with machine learning?

- text, sound, image, sensory
- often very large amounts of data



# What's so special about AI?

Like us, Als are able to fill in knowledge gaps.

They can draw on similarities. Let's do a demonstration.



**RESOURCE:** Simulation at <u>My Computer Brain</u> LESSON: <u>Home automation with AI</u> (Years 5-8)

# Considerations when teaching to the curriculum

What does Artificial Intelligence add?

When and how to combine AI and conventional programming?

# Conventional Programming

#### Algorithms

 opportunities to design, trace and test

Implementation

General Purpose programs
 involving branching,
 iteration, functions, data
 structures

Artificial Intelligence Data Representation text, image and audio in binary Data Collection, Data Interpretation Impact

# Our hands-on example

A simple 1-question quiz.

User can answer by pressing **y** or **n** on the keyboard.

Then, upgrade user interface so the user can answer with **thumbs-up** or **thumbs-down** on webcam.

# Our hands-on example

 Design and code a conventional program. (P5 JavaScript environment)

 Prepare an Al model for recognising thumb gestures. (Teachable Machine)

3. Bring the trained model into our program.

# 1. Design a conventional program



# 1. Design a conventional program



## 1. Code our conventional program

p5*	File 🔻 Edit 🔻 Sketch 💌 Help 💌						
Þ	Auto-refresh Thumbs quiz - keyboard only      by NathanDLTV						
>	sketch.js•	Saved: 21 minutes a					
1 2 3 4 5 6 6 7 7 8 9 10 11 12 13 14 15 16	<pre>let video; let answer; // This function occurs once at start. function setup() { // Set up the screen. createCanvas(640,480); textSize(20); textAlign(CENTER, CENTER); fill(255); // Start capturing video. video = createCapture(VIDEO); video.hide(); }</pre>						
18 19 20 21 23 24 25 26 27 28 29 30 31	<pre>// The function occurs repeatedly. function draw() {     background(0);     image(video, 0, 0);     text("Is Earth the closest planet to the Sun?", width / 2, 100);      let result = "waiting for you to respond"     if (answer == "yes") {         result = "Incorrect. Mercury is the closest planet to the Sun.";     } else if (answer == "no") {         result = "Correct!";     }     text(result width ( 2, height = 100);     } } </pre>						

We're using the **p5 environment** for JavaScript coding.

- Starting point
- Finished program (keyboard input only)

### 2. Prepare an Al model: consider data

How can we represent **Y** and **N** clearly?



We need **multiple photos** and different **angles** / **directions**. What about background?

#### 2. Prepare an Al model: train the Al 1. Collect data. Thumbs up 🧷 42 Image Samples <u></u> Upload Webcam Training Preview Export Model $\overline{\mathbf{x}}$ Train Model Thumbs down 🧷 You must train a model on the left before you can preview it here. Advanced V 38 Image Samples £ Upload Webcam

#### Google **Teachable Machine**



#### Google **Teachable Machine**

### 2. Prepare an AI model: test the model



Training

Advanced

Model Trained



### **3. Export the model**

Training

Advanced

Model Trained

V

Preview Treview	
Input 🕐 ON Webcam 🗸	
Logitech QuickCam Pro 9000 (046d: 🗸	
Output	
Thum up	
Thum 8 down	



### **3. Export the model**

xport your model t	o use it in project	s.
Tensorflow.js (j)	Tensorflow (i)	Tensorflow Lite (i)
xport your model:		
Upload (shareable lin	() O Download	✤ Upload my model
′our sharable link:		
https://teachablemach	ine.withgoogle.com/	models/[]
Vhen you upload your mo	del, Teachable Machin	ne hosts it at this link for free. (FAQ: <u>Who can use my model?</u> )
Code snippets to use you	model:	
Javascript	p5.js	Contribute on Github 🤇
Code snippets to use you Javascript Open up the code snippe	• model: 	Contribute on Github ( <u>p5.js Web Editor</u> .
<pre><duv <script="" cd="" classifier="" https:="" java="" leachable="" machine="" src="https://ud &lt;script type=" td="" text="" variable"<=""><td><pre>Image Model - pb.js a njs.cloudflare.com/aj njs.cloudflare.com/aj pkg.com/ml5@latest/di script"&gt; ////////////////////////////////////</pre></td><td>and m15.js jax/libs/p5.js/0.9.0/p5.min.js"&gt; jax/libs/p5.js/0.9.0/addons/p5.dom.min.js"&gt; ist/m15.min.js"&gt;</td></duv></pre>	<pre>Image Model - pb.js a njs.cloudflare.com/aj njs.cloudflare.com/aj pkg.com/ml5@latest/di script"&gt; ////////////////////////////////////</pre>	and m15.js jax/libs/p5.js/0.9.0/p5.min.js"> jax/libs/p5.js/0.9.0/addons/p5.dom.min.js"> ist/m15.min.js">
<pre>let classifier; // Model URL let imageModelURL = ' // Video</pre>	./my_model/';	

#### Teachable Machine hosts the model.



### 3. Export the model

Export your model to use it in projects.				
Tensorflow.js (j)	Tensorflow (i)	Tensorflow Lite 访		
Export your model:				
Upload (shareable lin	k) O Download	Update my cloud model		
Your sharable link:				
https://teachablemach	ine.withgoogle.com/m	models/c7SlyDUC_/	Сору 🔲	
✓ Your cloud model is up Code snippets to use you	to date. r model:			
Javascript	p5.js		Contribute on Github 💭	
Open up the code snippe	below directly in the	o <u>5.js Web Editor</u> .		
<pre><div>Teachable Machine <script <script="" cd="" classifier="" classifier;="" https:="" java="" let="" model="" pre="" src="https://ur &lt;script type=" text="" url<="" variabi=""></td><td><pre>Image Model - p5.js a injs.cloudflare.com/aj injs.cloudflare.com/aj pkg.com/ml5@latest/di iscript"> iscript"/ iscript"> iscript"/ iscript"/ iscript"> iscript"/ iscript// i</td><td>nd ml5.js</div> ax/libs/p5.js/0.9.0/p5.min.js"></ ax/libs/p5.js/0.9.0/addons/p5.dom st/ml5.min.js"></script></div></pre>	Copy [] Script> .min.js">			
let imageModelURI = '	https://teachablemach	ine withgoogle com/models/c7SlyDU	IC // +	

#### This unique URL is what we need to use the model.



# 3. Bring the model into our program

p5*	File 🔻 Edit 🔻 Sketch 🔻 Help 💌	
	Auto-refresh Thumbs quiz - final 🖉 by NathanDLTV	
>	sketch.js Saved: 15 seconds a	go
	<pre>// Teachable Machine model: https://teachablemachine.withgoogle.com/models/c7SlyDUC_/model.jsor let classifier; let video; let answer;</pre>	1
10 11 11 11 11 11 11 11 11 11 11 11 11 1	<pre>// This function occurs before anything else. vfunction preload() {  // Load the trained model.  classifier = ml5.imageClassifier('https://teachablemachine.withgoogle.com/models/c7SlyDUC_/model.json'); } // This function occurs once at start. vfunction setup() {  // Set up the screen.  createCanvas(640,480);  textSize(20);  textAlign(CENTER, CENTER);  fill(255); </pre>	
2:22	<pre>// Start capturing video. video = createCapture(VIDEO); video.hide(); // Begin classifying what you see. classifier.classify(video, gotResults); }</pre>	

Back to the p5 environment.

- New starting point
- Final program with gesture recognition

# **Relevant lesson ideas**

#### Rock, Paper, Scissors, Al!

Similar to the hands-on example we just did. Train an AI model and demonstrate adding it to a program.

Expand on this lesson to have the computer play Rock, Paper, Scissors with you!

#### Home automation: General Purpose programming

Use JavaScript in the Pencil Code environment to incorporate speech recognition in a program.

Also can be done in Python (with limitations).

LESSON: <u>Rock, Paper, Scissors, All</u> (Years 7-8)

LESSON: Home automation: General Purpose programming (Years 7-8)



# Pedagogy, property and privacy

Coding brings its own pedagogical challenges.

Remixing is a chance to discuss intellectual property.

Al involving images and voices also bring privacy considerations.

# Remixing

In each programming lesson, sample code is provided.

Isn't that just giving students the answer?

This is an **evidenced-based approach**, and reflective of **real world** programming.





Image: United Kingdom Department of Education

**PRIMM** is one approach that can help teachers structure lessons in programming.

#### **Use-Modify-Create adapted**



From blog post: <u>Exploring pedagogies for teaching</u> programming in school

A learner runs (**uses**) an existing program to see what it does, then **modifies** it, and then when able, **creates** a new project of their own.

# Let's apply remixing

What could students do to tinker with the quiz program we just made?

What fresh projects could be inspired?

- add a third gesture ("not sure")
- multiple choice quiz and use AUSLAN letters A, B,
   C or D to answer
- three quiz questions and give a score
- a timed game: choose the right gesture quickly



Also an opportunity to discuss **intellectual property**, part of ICT General Capability.

In the real world programmers often **adapt** others' work. Where is the line between adapting and simply copying?



# Privacy

Students photographing their own face or recording their own voice is a privacy concern.

What alternatives could you do for your coding activities?

- emojis
- toys
- fruit / vegetables
- semaphore and poses
- sign language\*\*



### E-safety: risk assessment

Effectively plan and assess risks and benefits before introducing any new online platforms or technologies.

#### eSafety education

#### **New technologies** risk-assessment tool

#### eSafety Toolkit for Schools

Creating safer online environments

This risk-assessment tool can help schools to effectively plan and assess risks and benefits before introducing any new online platforms or technologies. Additional research about the platform/technology is recommended if you are unsure of the answer to one or more of the questions.

For technical questions, ask for guidance from an appropriately qualified advisor, member association or technology support staff. You might also check with staff who have already adopted the technology or platform it wishes to use, staff will need to be shown how to use the technology, and how to integrate its use into the curriculum. Staged implementation may help to avoid unintended or unexpected consequences of student use. Usage should be consistent with, and informed by, education department or sector policies and procedures.



#### New technologies risk-assessment tool



Prepare: Resource 3

0000

#### E-safety: risk assessment

Risk identified: take appropriate action to mitigate risks before using

Proceed with caution: continue to monitor for risks

Consider	Yes	No	Suggestions to mitigate risks
Will students' personal information be publicly displayed (e.g. photograph, date of birth, gender or name of school)?			<ul> <li>Obtain consent from students and their parents/carers before displaying personal information online.</li> <li>Where possible, de-identify student information.</li> </ul>
Can external, unauthorised users communicate with students?			<ul> <li>Install appropriate technologies to monitor and filter activities on school ICT systems.</li> <li>Teach students strategies to report external, unauthorised communication and block inappropriate content or contact.</li> </ul>
Does the platform encourage students to use their existing email or social networking accounts for sign in or use?			<ul> <li>Often platforms also have the option to sign up or log in using unique usernames and passwords. While using existing social networking accounts might be quicker, unique logins are a safer option.</li> <li>Teach students the importance of strong passwords and not sharing passwords.</li> </ul>
Are student profiles linked to apps that can display their location?			<ul> <li>Teach students strategies to turn off location services functions, or to block apps that have these turned on.</li> </ul>
Does the education department prohibit the use of this technology or platform?			<ul> <li>If the education department's policies prohibit the use of this technology or platform it is recommended not to use it.</li> </ul>
Can students access inappropriate content using this technology or platform?			<ul> <li>Install appropriate technologies to monitor and filter activities on school ICT systems.</li> <li>Encourage help-seeking behaviours so students know the steps to take if they come across inappropriate content.</li> </ul>

5

#### E-safety: risk assessment

Consider	Yes	No	Suggestions to mitigate risks
Have minimum age requirements for the technology or platform been adhered to?			<ul> <li>Check age appropriateness prior to use.</li> <li>Teach students about age recommendations and the reasons behind them.</li> </ul>
Does the platform promote privacy and security for students and their accounts?			<ul> <li>Empower students to protect their privacy and explain how to adjust security settings.</li> </ul>
Have parents/carers consented to their child using this technology or platform?			• Ensure appropriate consent has been provided by parents/carers. Some schools request consent to use a broad range of platforms at the start of the school year to avoid having to ask for consent each time a new platform is used. It's important to be as clear as possible about what this consent includes, as well as providing information on any possible risks to users and how the school mitigates them.
Are staff comfortable and confident using the platform?			<ul> <li>Provide access to professional learning so staff are skilled in the platforms/technologies they use.</li> </ul>
Is there a staff member moderator for chat or comment functions?			• A staff member (or team) would ideally be appointed to moderate chat or comment functions, to encourage safe and positive interactions and to take down and investigate inappropriate posts.
Does the platform have capacity to report problems or misuse?			<ul> <li>All platforms should have terms of use that clearly identify inappropriate content or behaviour, and how to report problems or misuse.</li> <li>Visit <u>The eSafety Guide</u> for more information.</li> </ul>
Do all users know how to set the platforms' privacy settings?			<ul> <li>Share <u>The eSafety Guide</u> with staff. This has links to the latest games, apps and social media, with tips on how to set privacy settings.</li> </ul>
Have you identified how data is stored and used by the platform?			<ul> <li>Privacy issues arise when data is collected and not stored securely or shared inappropriately. Good practice is to find out how data will be stored and who has access.</li> <li>Check education department or sector policies to see if there are any standard protocols schools should follow, as well as advice about privacy legislation and data storage.</li> </ul>

# Assessment

Artificial Intelligence is a rich field for assessment opportunities.

Here are a few examples in the core concept areas of data, algorithms, implementation and impact.

#### Data representation, Impact

#### Train and test an AI model

- Rate how well the AI recognised objects.
- Discuss the training data used.
- List ways it may be improved.

#### **Research Algorithmic Bias**

- Discuss real-world examples of algorithmic bias.
- Consider social impact.

#### Data representation, Algorithms, Implementation

# Utilise a trained AI model in a coded program

- Design and develop a program in a suitable environment such as **p5** JavaScript.
- Import the AI model and use it to drive the program's decisions.
- Assess General Purpose Programming with a suitable rubric.

# Students' use of apps & tools

#### Think Aloud: Student interview

Screen captures or saved program

#### **Self-reflection**

 What they learned, challenges, checklist/rating their skills before/after

#### Analysis

- Artefacts such as worksheets or analysis of AI tools, applications and real world uses.
- Criteria used

#### Artificial Intelligence lesson plans

Humans display natural intelligence in contrast to machines that demonstrate artificial intelligence (AI).

Al has various definitions however for our purposes we are using the definition 'any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals' [1]. Read more ...

The following lesson ideas cover a range of specialisations and subsets as indicated by the colour coding. Click on the coloured squares to learn more about each definition.



# Lesson plans

**Artificial Intelligence** 

#### Access DT Hub Al lesson plans

9-10 Recognising Al Use the tasks in this lesse introduce concepts that, artificial intelligence (Al) majority of the tasks an unplugged ido not res digital device).

mob

light

5-6



7-8

(NLP) interprets text and speech. Chatbots provide a useful context to explore NLP. In this module students code a chatbot in Home a Python, a conversational program capable of responding in varied Home voice ways to user input, including with recog the use of smart sentiment



Al ethics - What's possible probable, and preferred? The development and ubiquity of Artificial Intelligence raise a number of social and ethical matters that students can explore in the Digital Technologies classroom. This lesson idea outlines a project to help students frame such discussions



Explore text analysis through

Intelligence. View a series of

Python program that can break

down and analyse the content of

a complete text, such as Robert

Louis Stevenson's Treasure Island

and use smart sentiment analysis

to attempt to determine the

villain(s) and hero(s).

video tutorials to develop a

Natural Language Processing, a

significant application of Artificial



What would my preferred Al future look like? Malyn Mawby, Head of Personalised Learning at Roseville College, explains how she implemented project-based learning (PBL) with her year 10 class to explore Artificial Intelligence (Al). Through the PBL task, students selected an area of interest and investigated what is possible, probable, and preferred.



1



applications thical understanding

lan explores the ts of artificial and the implications

# A chance to ask questions ...



#### Use the chat...

How can you incorporate these teaching ideas?

What do you feel more confident about?

What do you still need to know?

# Next steps

Making a commitment to implementing AI in your classroom

Use the chat to **write your idea** of where you will include AI as part of your teaching and learning program.

Connecting and sharing with the group.

email:

digitaltechnologieshub@esa.edu.au





# **Other Deep Dives**

Deep dive 2: Investigate a machine learning model	Thurs 19th August 2021
Deep dive 3: Natural language processing for large text analysis	Tues 24th August 2021
Deep dive 4: AI, ethics and systems thinking	Tues 7th Sept 2021

