

AI in Schools – Unplugged Activity

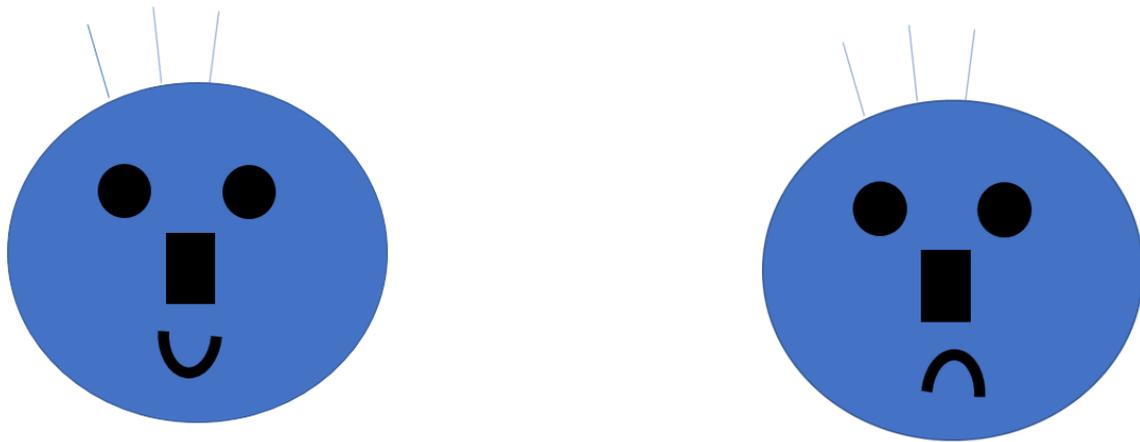
Forward Propagation

Instructions
Arrange the class as shown in figure 1
Explain that there is the input layer, the hidden layers in the middle and the output layer. Each neuron looks for a particular feature, a fixed shape or pattern. Each layer is going to be looking for more complex patterns of features. Such neurons are called feature detectors.
Program/train each pupil (neuron) in each layer with their features to detect (I.e. Nose, Eyes etc). Do this by giving all the pupils the appropriate cards as per figure 2 - these cards are provided in the unplugged folder.
We input the data to the network – layer 1. The teacher (layer 1) stands at the front and shows the input image(s) (only pupils/neurons in layer 2 are to act upon what they are shown and they turn their card over/show their card and shout “fire or bingo” if they have been “programmed”/”trained” with any of the features from the teacher’s image. (This stage means the input image features are separated, broken down and each is now a picture somewhere on layer 2).
After the pupils in layer 2 have identified the feature they are looking for they turn around in turn one at a time and show their cards to layer 3 pupils/neurons
Layer three pupils then identify which of the individual features shown by the layer 2 pupils they are looking for and if they have them they turn the cards over and shout “fire/bingo”. For example, layer 2 pupils show a card of two open eyes and a nose, and the layer 3 pupil is detecting two open eyes and a nose, the layer 3 pupil shouts “fire/bingo”
After each pupil in layer 3 has identified all the features they are looking for, layer 3 pupils turn around in turn and show their cards of their detected features to layer 4 pupils/neurons
Layer 4 pupils then identify which features they are looking for if they are a happy face they will shout “fire/bingo – Happy Face” and if they are a “Sad face” they will shout “fire/bingo – Sad Face”
Layer 4 pupils will then have either a Sad face, Happy Face or No Face. If they have Happy Face or a Sad face they are to pass these to Layer 5 which is the output layer. The process that the pupils would have completed is forward propagation through the network.

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Figure 1:

** The yellow shaded columns are included here as a guide to remind the teacher what each layer is called. This naming needs to be pointed out to pupils as they are arranged. If your class is larger than 17 pupils, then have other pupils, stand around and observe what is going on through the neural network, their job will be to feedback what they have seen. Use the supporting notes in the teacher’s PowerPoint for questions to ask the pupils during the unplugged activity.



Layer 1 Input Layer	<ul style="list-style-type: none"> Teacher or another pupil is to show layer 2 pupils each card individually
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Layer 2 Hidden Layer	Eyes E	Nose N	Hair H	Smiley Face U	Sad Face S
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Layer 1 is looking for 1 feature

Layer 3 Hidden Layer	Hair + Sad mouth HS	Eyes + Smiley mouth EU	Hair + Eyes HE	Eyes + Nose EN	Sad Mouth + Smiley Mouth + Nose SUN	Nose + Smiley Mouth NU
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Layer 3 is looking for up to 3 features

Layer 4 Hidden Layer	Hair + Eyes + Nose + Sad Mouth HENS	Hair + Eyes + Nose + Smiley Mouth HENU	Hair + Eyes + Smiley Mouth + Sad Mouth HEUS	Eyes + Nose + Smiley Mouth + Sad Mouth ENUS
	SAD FACE	HAPPY FACE	NO FACE	NO FACE

Layer 4 is looking for 4+ features

Layer 5 Output Layer	Smiley/Happy Face U	Sad/Frowning Face S
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Figure 2:

** In the activity each of these squares will represent a card (excluded the yellow squares, the yellow is purely to remind the teacher which layers are being worked with so that this can be explained to the pupils).

Layer 1 Input Layer	Input Layer <ul style="list-style-type: none"> Teacher or another pupil is to show layer 2 pupils each card individually
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Layer 2 Hidden Layer	Eye E	Nose N	Hair H	Smiley Face U	Sad Face S
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Layer 1 is looking for 1 feature

Layer 3 Hidden Layer	Hair + Sad Face HS	Eyes + Smiley Face EU	Hair + Eyes HE	Eyes + Nose EN	Sad Face + Smiley Face + Nose SUN	Nose + Smiley Face NU
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Layer 3 is looking for up to 3 features

Layer 4 Hidden Layer	Hair + Eyes+ Nose + Sad Face HENS	Hair + Eyes + Nose + Smiley Face HENU	Hair + Eyes + Smiley Face + Sad Face HEUS	Eyes + Nose + Smiley Face + Sad Face ENUS
	SAD FACE	HAPPY FACE	NO FACE	NO FACE

Layer 4 is looking for 4+ features

Layer 5 Output Layer	Smiley/Happy Face U	Sad/Frowning Face S
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