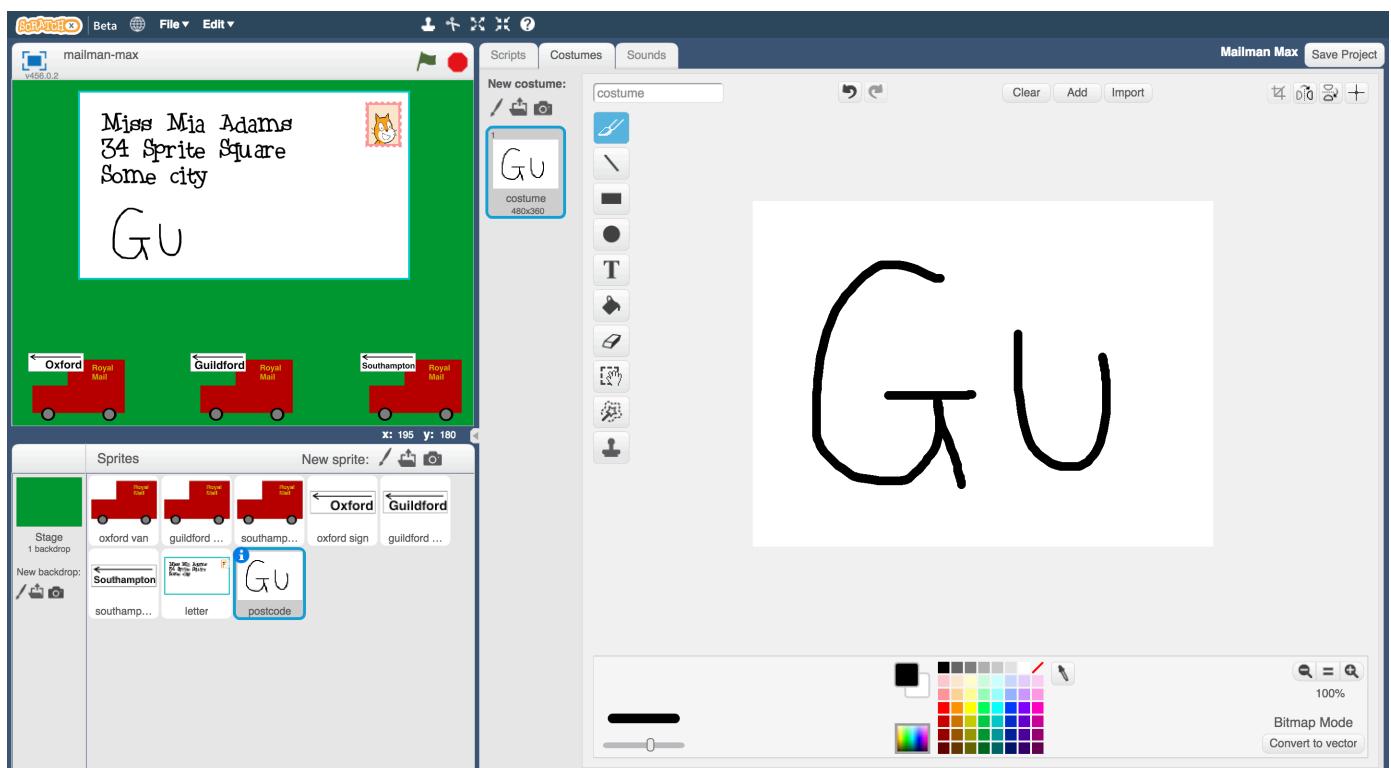


Mailman Max

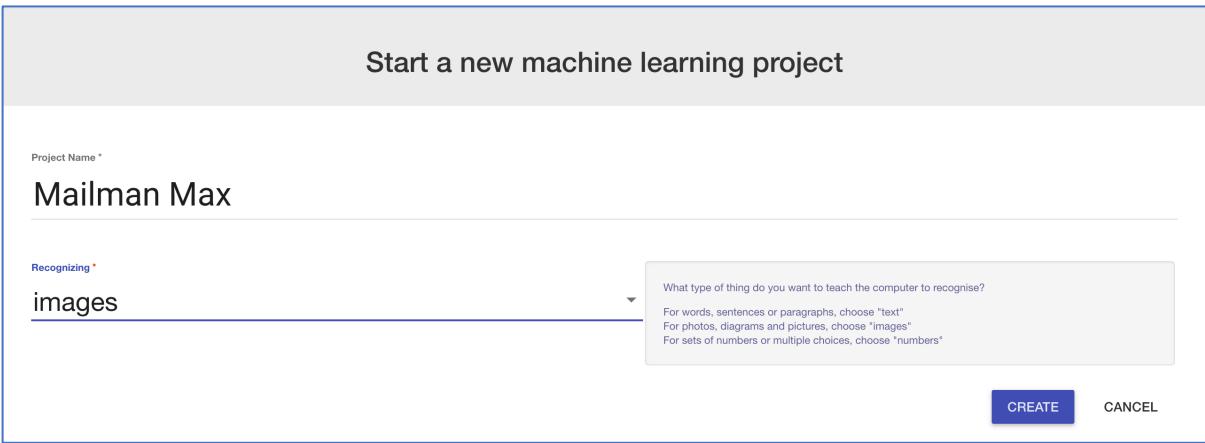
In this project you will make a main postal sorting office. It will need to sort letters so that they can be put into vans going to the right local sorting offices.

The postcode is a great way to work out the next sorting office a letter should go to, so you'll use that.

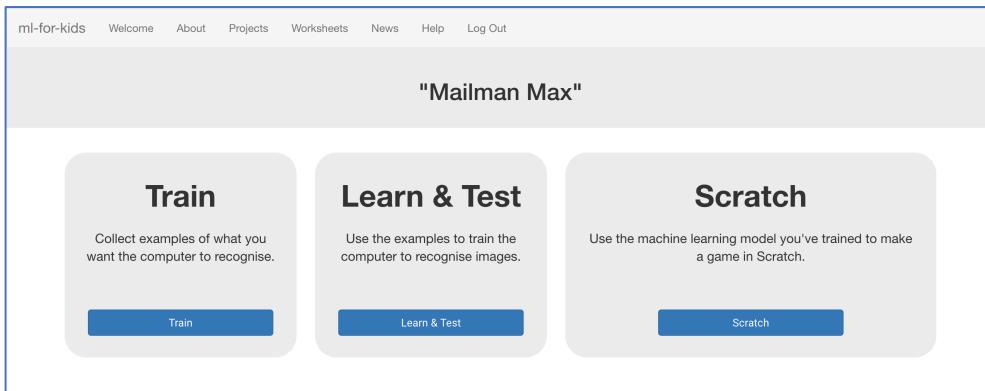
You'll train the computer to recognise what the different codes at the start of a postcode look like when they are hand-written, and use that to sort letters.



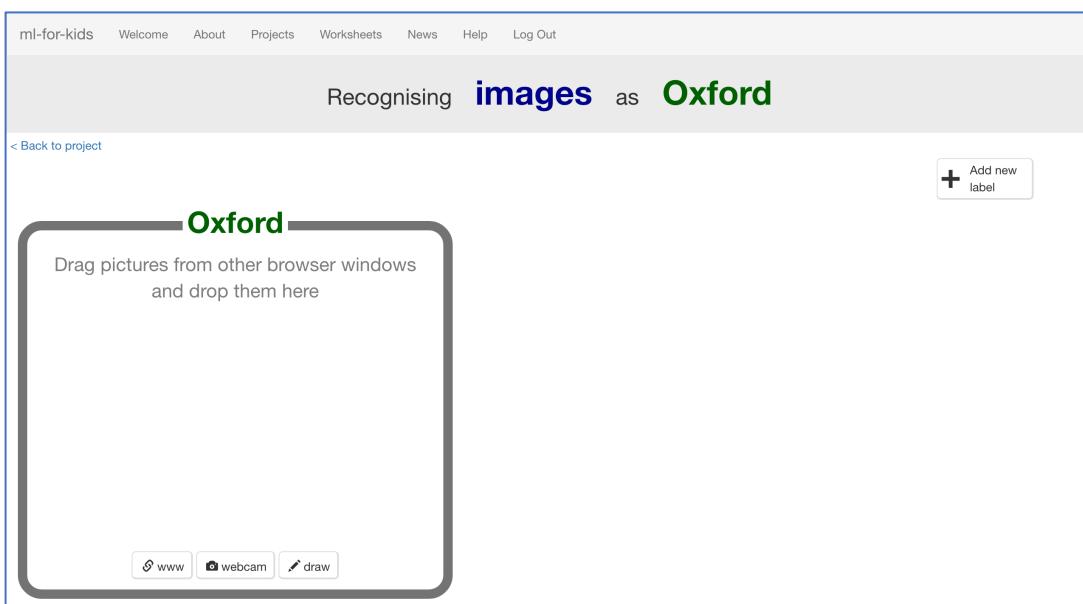
This project worksheet is licensed under a Creative Commons Attribution Non-Commercial Share-Alike License
<http://creativecommons.org/licenses/by-nc-sa/4.0/>

- 1.** Go to <https://machinelearningforkids.co.uk> in a web browser
- 2.** Click on “**Get started**”
- 3.** Click on “**Log In**” and type in your username and password
If you don't have a username, ask your teacher or group leader to create one for you.
If you can't remember your password, ask your teacher or group leader to reset it for you.
- 4.** Click on “**Projects**” on the top menu bar
- 5.** Click the “**+ Add a new project**” button.
- 6.** Name your project “Mailman Max” and set it to learn how to recognise “**images**”.


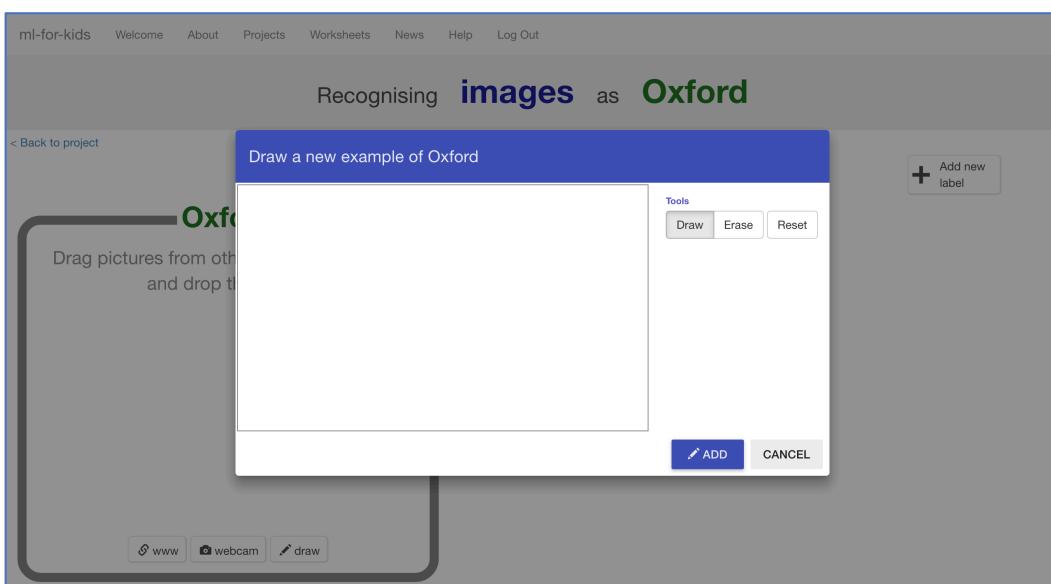
9. Click the “Train” button



10. Click the “Add new label” button, and create a label called “Oxford”



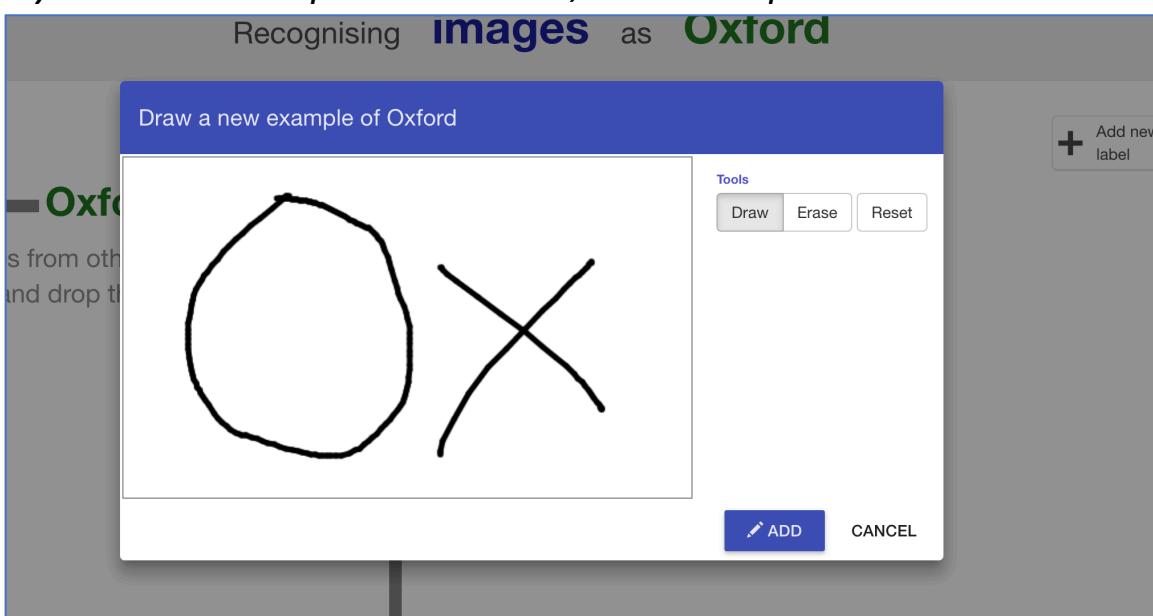
11. Click the “draw” button in the “Oxford” bucket



12. Use your mouse to write “OX” in the empty box.

OX is the start for postcodes in the Oxford area.

Try to use all the space in the box, like in the picture below.



13. Click “ADD”

14. Click “Draw” again, and draw another “OX”

15. Repeat until you've got **10** examples of “OX”

16. Click “Add new label” again, and create one called “Guildford”

The screenshot shows a web interface for labeling images. At the top, there's a navigation bar with links: ml-for-kids, Welcome, About, Projects, Worksheets, News, Help, and Log Out. Below the navigation, the title "Recognising images as Oxford or Guildford" is displayed. A "Back to project" link is on the left. On the right, there's a "Add new label" button with a plus sign. Two main sections are shown: "Oxford" and "Guildford". The "Oxford" section contains a grid of 10 handwritten labels, each reading "OX". The "Guildford" section has a placeholder text "Drag pictures from other browser windows and drop them here" and a "draw" button. At the bottom of each section are three buttons: "www", "webcam", and "draw".

17. Use the “Draw” button in the “Guildford” bucket to draw 10 “GU” for postcodes in the Guildford area

This screenshot shows the same labeling interface after drawing 10 "GU" labels in the "Guildford" bucket. The "Oxford" bucket still contains its original 10 "OX" labels. The "Guildford" bucket now contains 10 handwritten "GU" labels, all drawn using the "draw" button. The rest of the interface, including the navigation bar, title, and other buttons, remains the same.

18. Click “Add new label” again, and create one called “Southampton”

19. Draw 10 “SO” examples for postcodes in the Southampton area

The screenshot shows a web application interface for collecting handwriting samples. At the top, there is a navigation bar with links: ml-for-kids, Welcome, About, Projects, Worksheets, News, Help, and Log Out. Below the navigation bar, the title "Recognising **images** as **Oxford, Guildford or Southampton**" is displayed. A "Back to project" link is located just below the title. On the right side of the page, there is a button labeled "+ Add new label".

Three separate boxes are provided for drawing postcodes:

- Oxford**: Contains five rows of two boxes each, all containing the handwritten postcode "Ox".
- Guildford**: Contains five rows of two boxes each, all containing the handwritten postcode "GU".
- Southampton**: Contains five rows of two boxes each, all containing the handwritten postcode "So".

Each box has three buttons at the bottom: "www" (link icon), "webcam" (camera icon), and "draw" (pencil icon).

20. Click on the “< Back to project” link

21. Click the “Learn & Test” button

22. Click the “Train new machine learning model” button

The screenshot shows the "Machine learning models" page. At the top, there is a navigation bar with links: ml-for-kids, Welcome, About, Projects, Worksheets, News, Help, and Log Out. Below the navigation bar, the title "Machine learning models" is displayed. A "Back to project" link is located just below the title.

The page is divided into two main sections:

- What have you done?**

You've collected examples of images for a computer to use to recognise when images are Oxford, Guildford or Southampton.

You've collected:

 - 10 examples of Guildford,
 - 10 examples of Oxford,
 - 10 examples of Southampton
- What's next?**

Ready to start the computer's training?

Click the button below to start training a machine learning model using the examples you've collected so far.

(Or go back to the Train page if you want to collect some more examples first.)

A large text input field labeled "Info from training computer:" is present at the bottom. A blue button labeled "Train new machine learning model" is located within this field.

23. Wait for the training to complete. This might take a few minutes.

ml-for-kids Welcome About Projects Worksheets News Help Log Out

Machine learning models

< Back to project

What have you done?

You've started training a machine learning model using the examples of images that you collected.

It's been training since Monday, November 6, 2017 4:13 PM.

This normally takes a few minutes, but can take a little longer if the training computer is very busy.

What's next?

You could wait for the machine learning model to finish being trained.

Or, you could try the machine learning quiz below, to check what you've learned.

Info from training computer:

Model started training at: Monday, November 6, 2017 4:13 PM
Current model status: Training
Model will automatically be deleted after: Monday, November 6, 2017 5:13 PM

[Cancel training](#)

24. Click the “< Back to project” link

25. Click the “Scratch” button

*This page has instructions on how to use the new blocks in Scratch
Keep the page open if you need to check back on how to use them.*

Using machine learning in Scratch

< Back to project

Your project will add these blocks to the **More Blocks** tab in Scripts.

recognise images [costume image] (label)
Put images in the input for this, and it will return the label that your machine learning model recognises it as.

recognise images [costume image] (confidence)
This will return how confident your machine learning model is that it recognises the type of images. (As a number from 0 - 100).

Oxford Guildford Southampton
These blocks represent the labels you've created in your project, so you can use their names in your scripts.

costume image
This block is in the Looks palette for Sprites and will return the image of the currently selected costume.

This means you can do something like this:

```
if [recognise images [costume image] = Oxford] then
  say [I think that is a picture of Oxford]
```

It will look something like this - except with the name of your project.

The coloured circle next to your project name tells you if your machine learning model is okay.

- **Green** means your model is trained and ready to go
- **Yellow** means your model hasn't finished training yet
- **Red** means something went wrong. Go back to the [Learn & Test](#) page to see what went wrong with training.

[Open in Scratch](#)

What have you done so far?

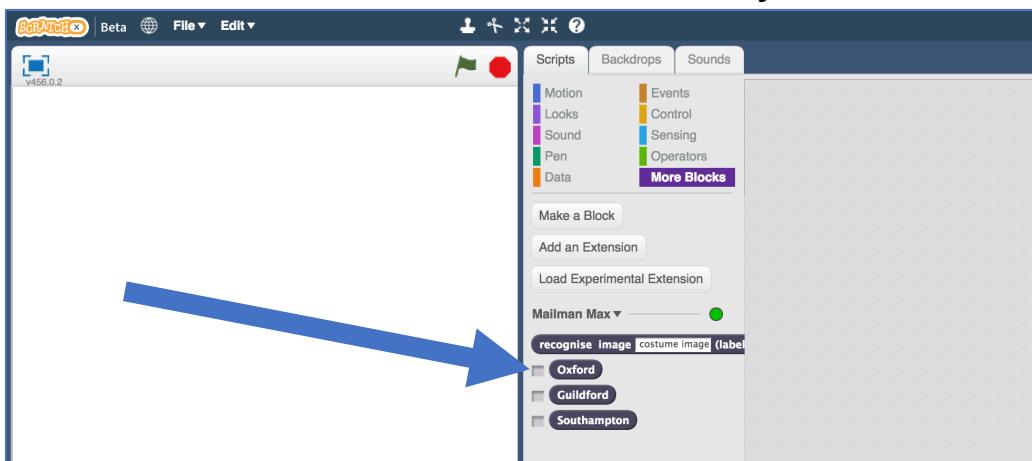
You've started to train a computer to recognise pictures of handwriting as being the start of postcodes for the Oxford, Guildford, or Southampton area. You are doing it by collecting examples of your handwriting. These examples are being used to train a machine learning "model".

This is called "supervised learning" because of the way that you are supervising the computer's training.

The computer will learn from patterns in the shapes of each of the examples you've drawn. This will be used to be able to recognise the postcodes we'll write on the envelopes to be sorted.

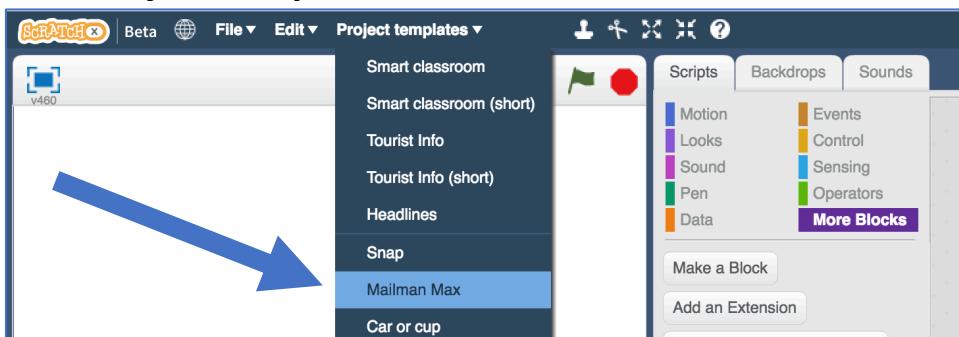
26. Click "Open in Scratch" to launch Scratch.

You should see new blocks in "More blocks" from "Mailman Max".



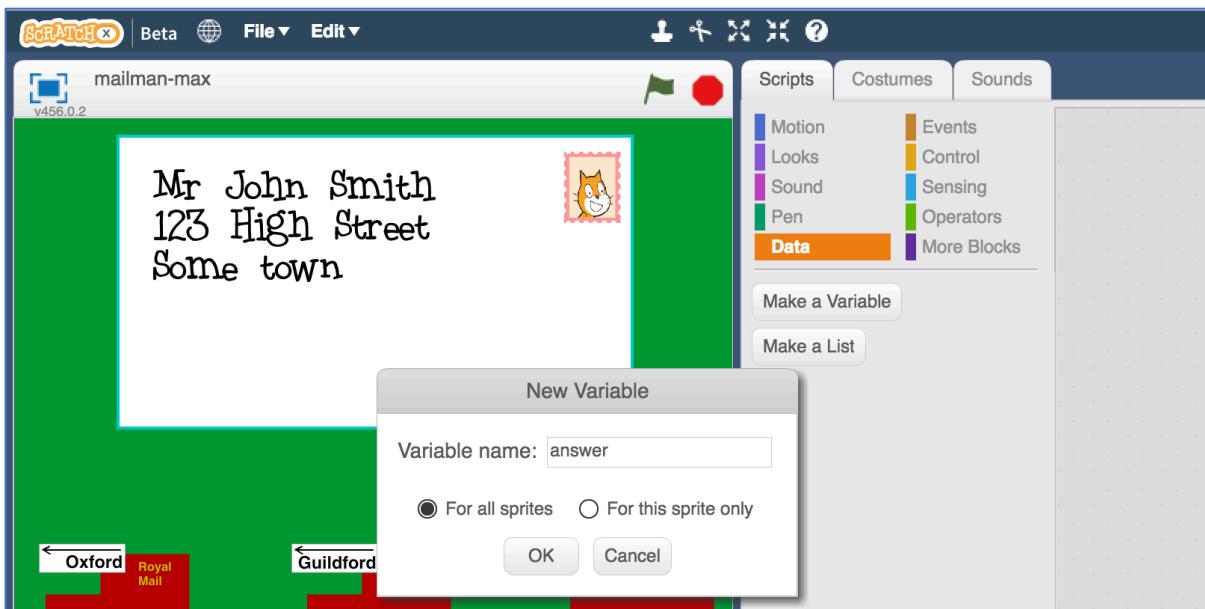
27. Open the Mailman Max project template

Click Project templates -> Mailman Max



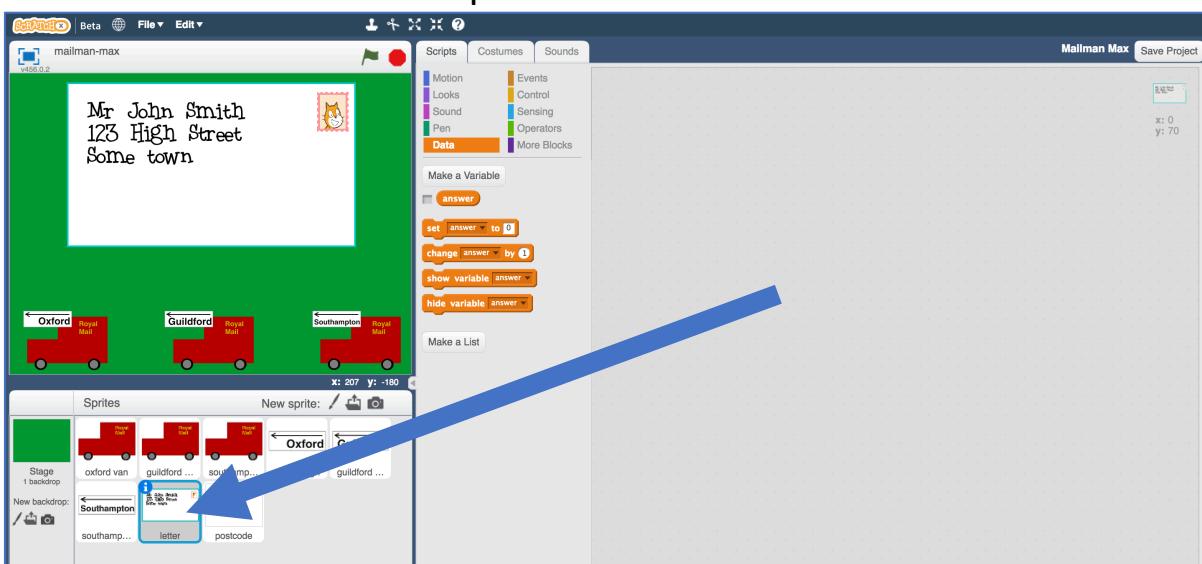
28. Click the “Data” tab

29. Click “Make a variable” and create a variable called “answer” which is available “For all sprites”

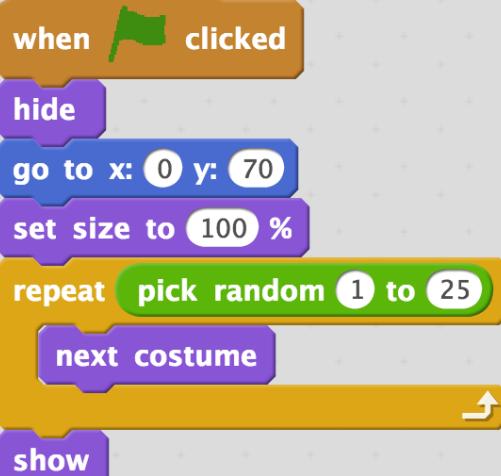


30. Untick the “answer” variable so it isn’t shown on the Stage

31. Click on the “letter” sprite



32. Enter the following script to choose a random letter to sort



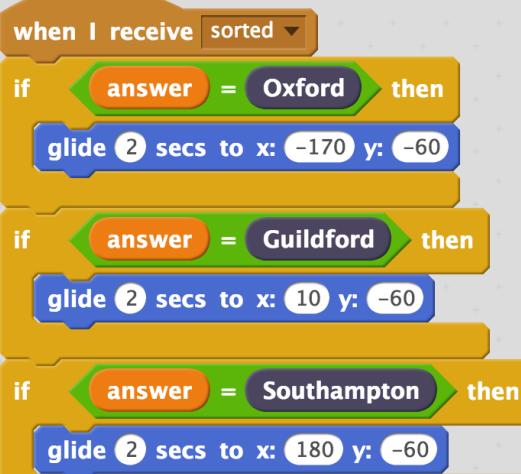
```
when green flag clicked
  hide
  go to x: 0 y: 70
  set size to 100 %
  repeat (pick random 1 to 25)
    next costume
  end
  show
```

33. Add the following script so that when we click on a letter it will get ready to be sorted.



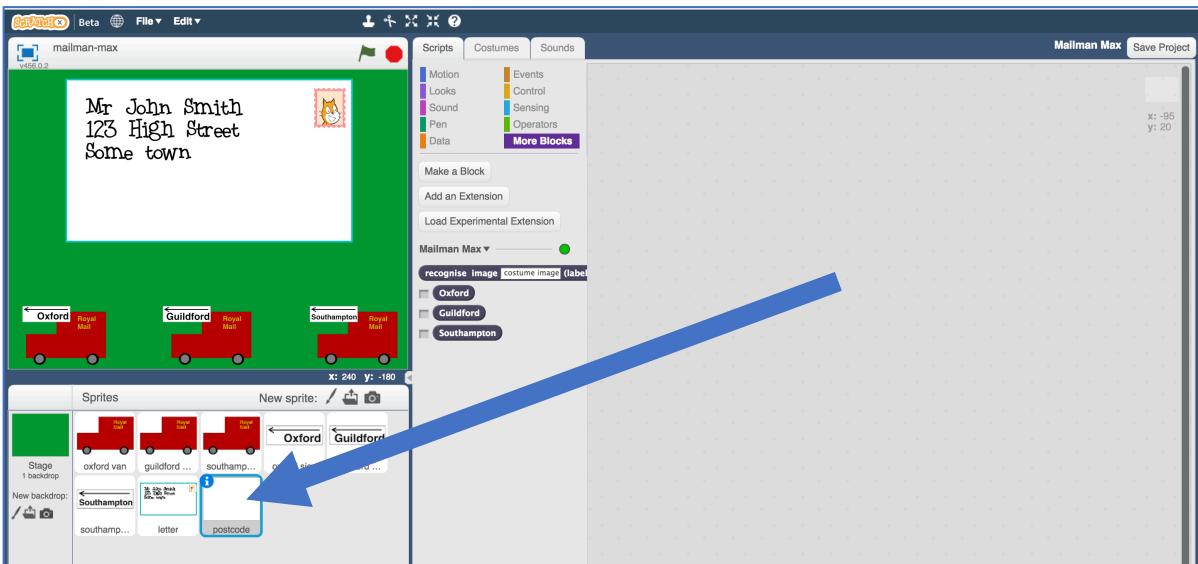
```
when this sprite clicked
  broadcast start sending
when I receive start sending
  go to x: 0 y: 70
  set size to 30 %
```

34. Add the following script so when the letter has been sorted, it goes to the post van to be taken to the correct regional sorting office.

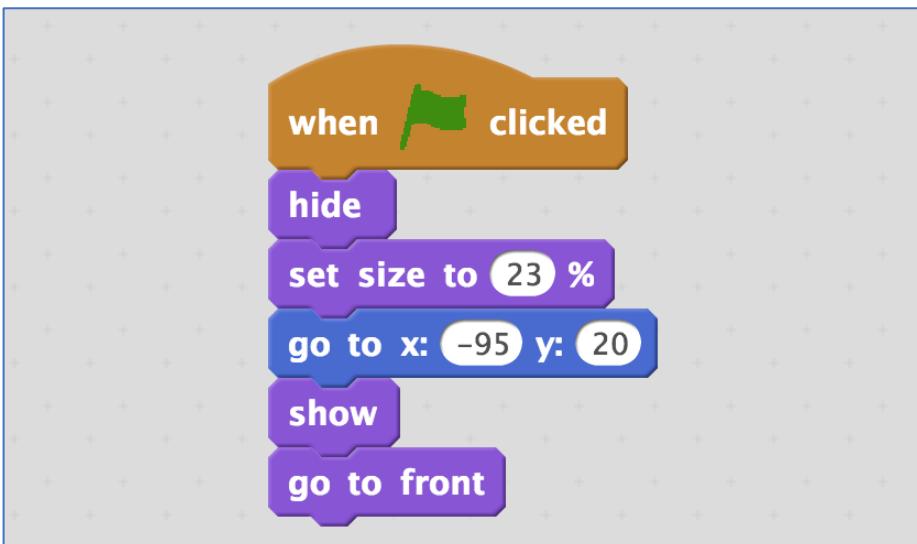


```
when I receive sorted
  if answer = Oxford then
    glide 2 secs to x: -170 y: -60
  end
  if answer = Guildford then
    glide 2 secs to x: 10 y: -60
  end
  if answer = Southampton then
    glide 2 secs to x: 180 y: -60
  end
```

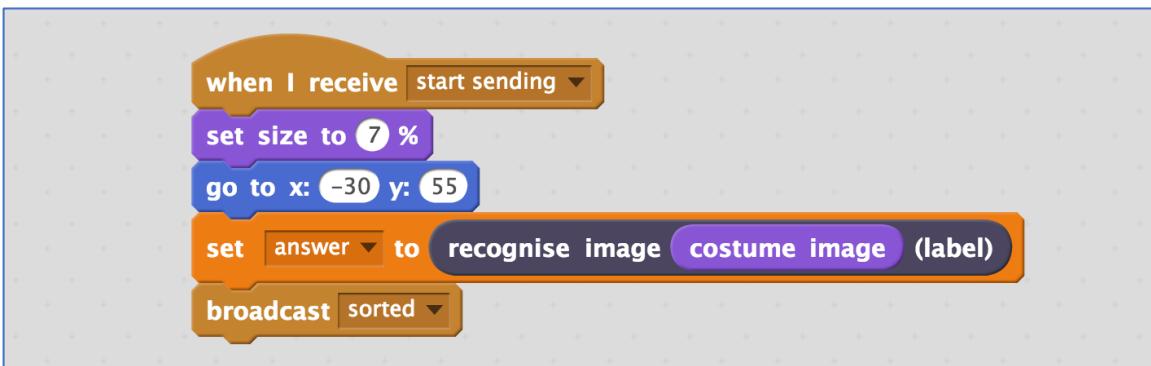
35. Click on “postcode” sprite



36. Enter the following script to get the new envelope ready for you to write a postcode on



37. Add the following script to get the computer to try and recognise the postcode you write on the envelope.

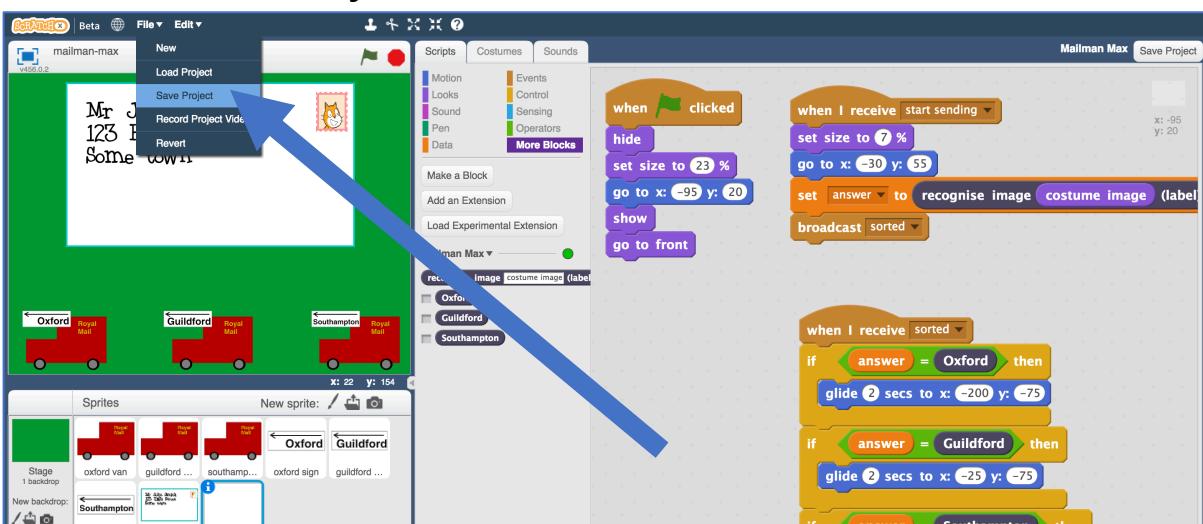


38. Add the following script to get the handwritten postcode to go with the rest of the envelope, to the post van to be taken to the correct regional sorting office.



39. Save your project

Click File -> Save Project

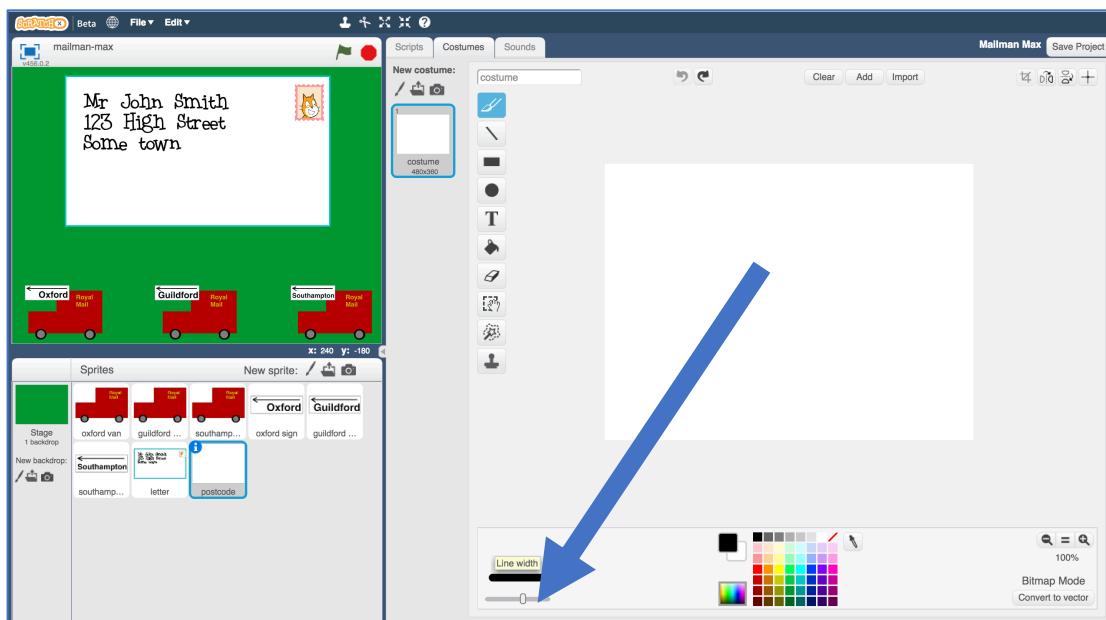


It's time to test!

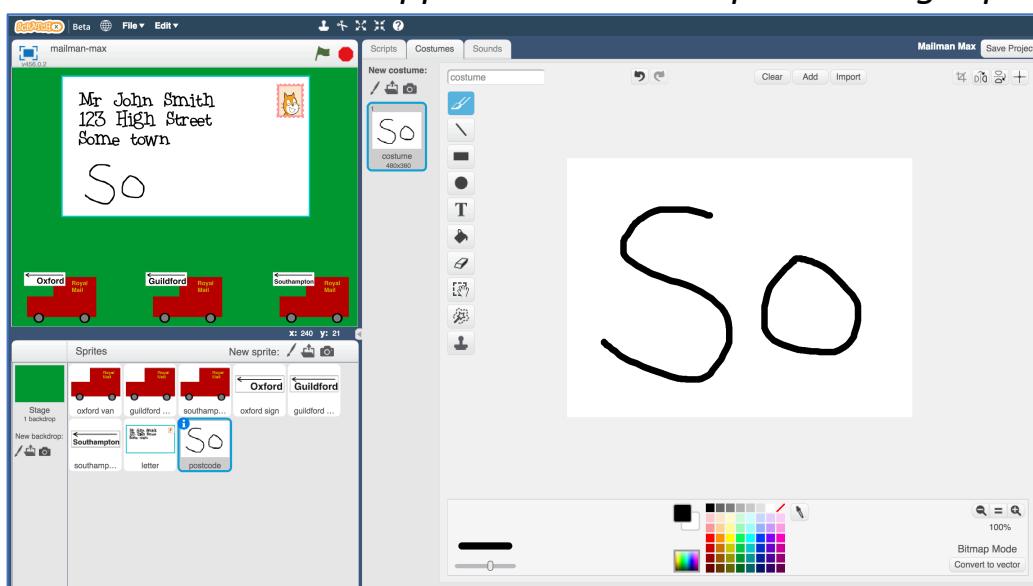
40. Click the Green Flag

41. Still on the “postcode” sprite, click on “Costumes”

42. Use the line width slider so we can write a thick black line

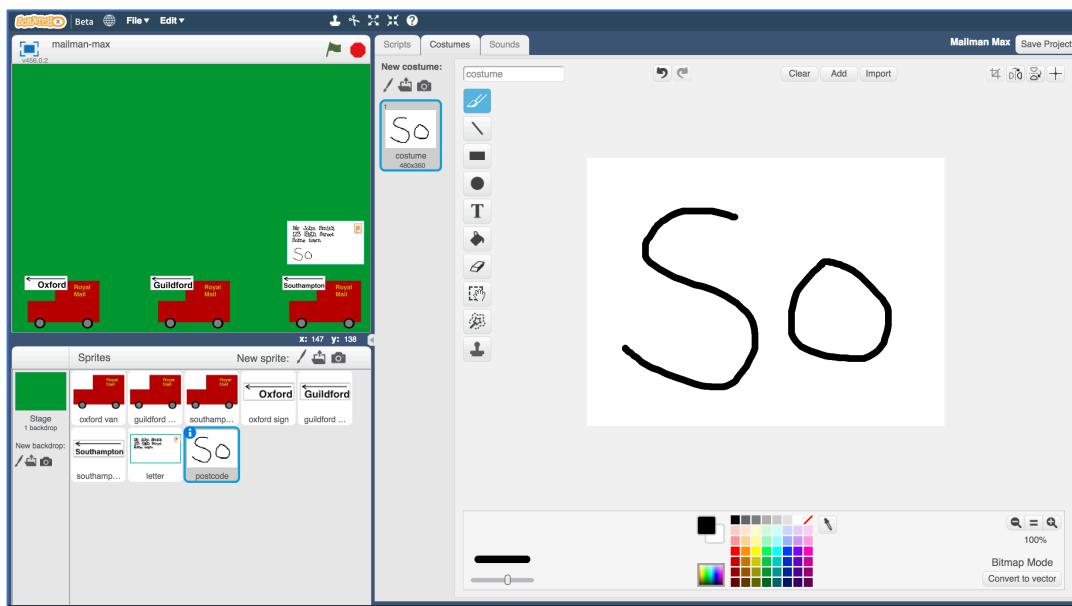


43. Write the first two letters of a postcode using the paintbrush tool.
Fill the space, like you did with the training examples.
You should also see it appear in the envelope in the right place.



44. Click on the stamp in the envelope in the stage.

You should see the letter shrink. Then the computer will try to recognise the postcode letters you've written. Once it thinks it has the answer, the envelope will move to the van for the correct sorting office.

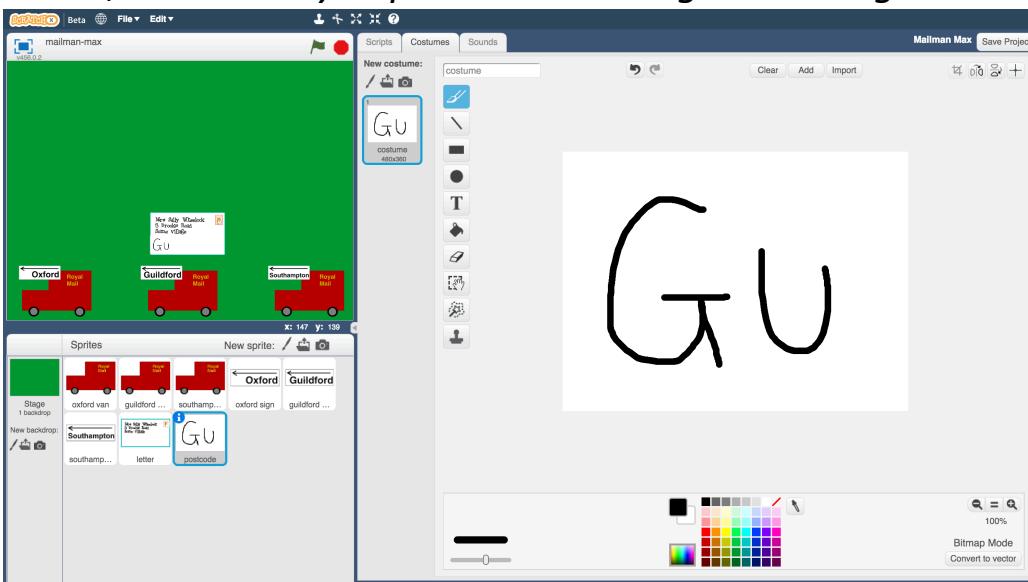


45. Did it get it right?

If it's not very good, you might need to add some more examples, and train a new machine learning model with them.

46. Repeat steps 41-46 to try it again with a different postcode

You'll need to paint over your first postcode in white first. If you use the eraser, make sure you put a white background in again.



What have you done?

You've trained a machine learning model to be able to do handwriting recognition. This is called "optical character recognition" or "OCR" for short.

You did that by collecting examples of handwriting, to train the computer to be able to recognise it.

You built a small and simple example, using just the first two letters for just three postcode areas.

Imagine doing the same thing for every postcode area in the country. You'd have to create a lot more training buckets to cover the 120 postcode areas in the UK. And you'd need to collect thousands of training examples, with lots of different people's handwriting, so that the computer could get really good at recognising them.

That is how large postal sorting offices sort our letters in real life.

Ideas and Extensions

Now that you've finished, why not give one of these ideas a try?

Or come up with one of your own?

Try someone else's handwriting

You've trained the computer to recognise how you write the postcode letters, but would it be able to recognise someone else's?

Ask a friend to test it and see if it works.

If it doesn't, you'll need to get some examples of their writing to add to your training data. The more people you can get training examples from, the better the computer will be at recognising a variety of handwriting styles.

Try more of the postcode

We made it easier for the computer by only giving it the first two letters.

But how can we get it to recognise something like "OX1 2JD" as being a postcode in the Oxford area?

If you collect a variety of different training examples of actual full postcodes (not just the first two letters) you should be able to train it to recognise them. That will probably need more than 10 examples!