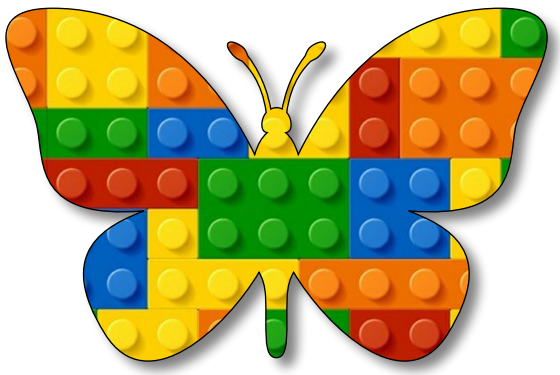
Artificial Intelligence Module B Unit #5 pretrained speech



Content

Module B Unit #5 speech classification with ml5.js

Introduction to pretrained soundClassifier with ml5.js

This example demonstrates speech classification using the SpeechCommands18w pretrained model. We will look at the basic model and see how good it is and then use some of those commands to move an object around. There are 18 words and they are as follows:

Zero, One, Two, Three, Four, Five, Six, Seven, Eight, Nine, Up, Down, Left, Right, Go, Stop, Yes, No

You will need to allow access to the microphone on your computer (assuming there is one). The results can be a bit sketchy but it is a good demonstration of what can be achieved. One real world application is a wake word similar to a smart speaker.

The index.html file

Adding the code line for ml5.js

```
<!DOCTYPE html>

<html lang="en">

  <head>

    <script src="https://cdnjs.cloudflare.com/ajax/libs/p5.js/
1.11.1/p5.js"></script>

    <script src="https://cdnjs.cloudflare.com/ajax/libs/p5.js/
1.11.1/addons/p5.sound.min.js"></script>

    <script src="https://unpkg.com/ml5@1/dist/ml5.min.js"></
script>

    <link rel="stylesheet" type="text/css" href="style.css">

    <meta charset="utf-8" />


  </head>

  <body>

    <main>

    </main>

    <script src="sketch.js"></script>

  </body>

</html>
```

Sketch B5.1 the preload starting sketch

We will preload the pretrained model. We want it to have a confidence score of `0.7` or higher. We load `SpeechCommands18w` from ml5.js

```
let classifier

function preload()
{
  ml5.setBackend("webgl")
  let options = {probabilityThreshold: 0.7}
  classifier = ml5.soundClassifier("SpeechCommands18w")
}

function setup()
{
  createCanvas(400, 400)
}

function draw()
{
  background(220)
}
```

Notes

Nothing is meant to happen yet, all we have done is downloaded the model

Code Explanation

`let options = {probabilityThreshold: 0.7}`	The probabilityThreshold is a built in function
`classifier = ml5.soundClassifier("SpeechCommands18w")`	This is a speech classifier that uses the SpeechCommands18W pretrained words

Sketch B5.2 classifying

We want to start the pretrained model and classify the sounds/words using the `classifyStart()` function with a callback

```
let classifier

function preload()
{
  ml5.setBackend("webgl")
  let options = {probabilityThreshold: 0.7}
  classifier = ml5.soundClassifier("SpeechCommands18w")
}

function setup()
{
  createCanvas(400, 400)
  classifier.classifyStart(gotResults)
}

function draw()
{
  background(220)
}
```

🗒️ Notes

❗ you will get an error message if you run it now

We will want a `gotResults()` callback function

🛠️ Code Explanation

`classifier.classifyStart(gotResults)`	Starts the classification of the sounds

Sketch B5.3 the got the results

Once we have the results we need the callback function `gotResults()` and predict the label which will appear as the top, or highest, confidence score at `index[0]`. We will add the console log temporarily to see the results.

```
let classifier
let predictedWord = ""

function preload()
{
  ml5.setBackend("webgl")
  let options = {probabilityThreshold: 0.7}
  classifier = ml5.soundClassifier("SpeechCommands18w")
}

function setup()
{
  createCanvas(400, 400)
  classifier.classifyStart(gotResults)
}

function draw()
{
  background(220)
}

function gotResults(results)
{
  predictedWord = results[0].label
  console.log(predictedWord)
}
```

🗒️ Notes

It will pick up every sound and try to classify it. The output also depends on what data it is trained on, whose voices and what accents (American, British or a mixture). Another factor may be the sensitivity of your built-in microphone.

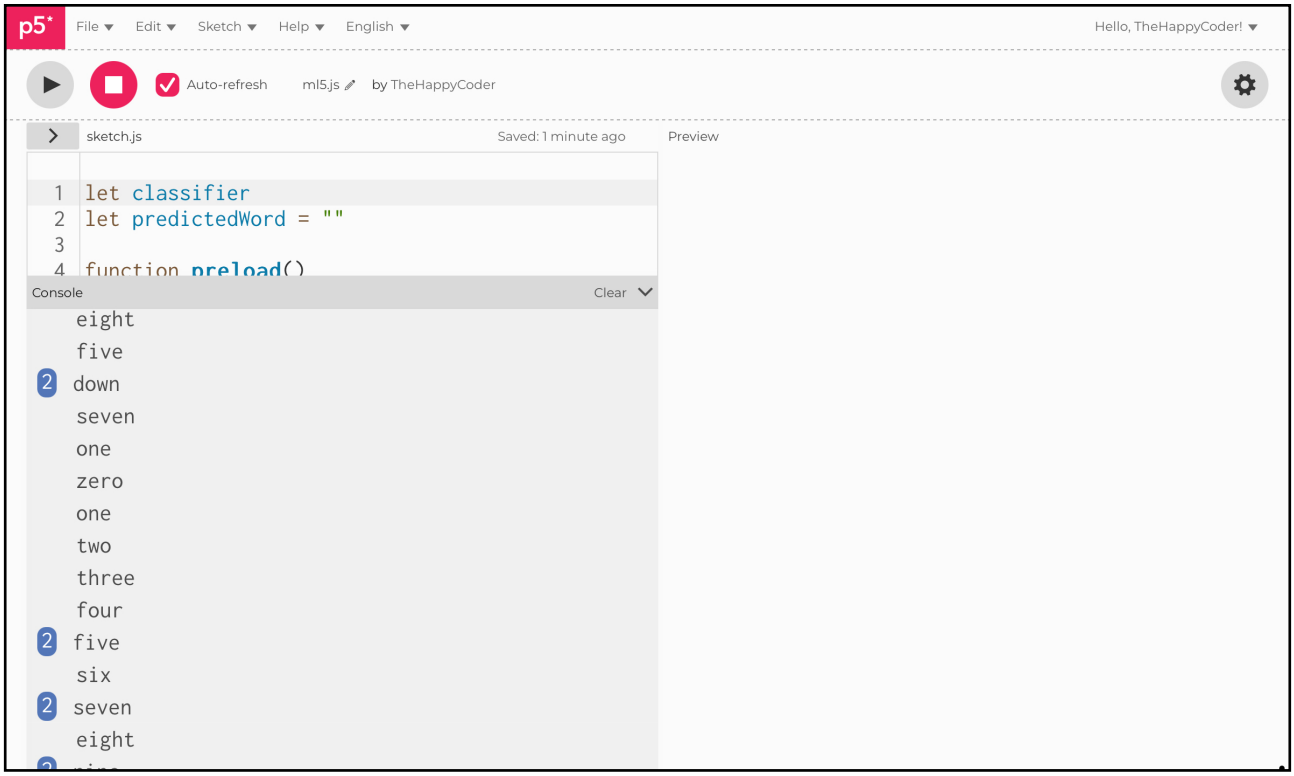
🌻 Challenge

Try different accents or shouting (quietly)

🛠️ Code Explanation

`let predictedWord = ""`	Declare and initialise an empty string variable
`predictedWord = results[0].label`	Finds the first label with the highest probability

Figure B5.3


p5*
File
Edit
Sketch
Help
English
Hello, TheHappyCoder!
Auto-refresh
ml5.js
by TheHappyCoder
sketch.js
Saved: 1 minute ago
Preview
1 let classifier
2 let predictedWord = ""
3
4 function preload()
Console
Clear
eight
five
2 down
seven
one
zero
one
two
three
four
2 five
six
2 seven
eight

Sketch B5.5 a moving ball

Removing the text result in draw, we will move the ball around the canvas with our voice. Add in the `edges()` function so that if it goes off the edge you don't lose it entirely. We will use the commands UP, DOWN, LEFT, RIGHT and STOP

```
let classifier
let predictedWord = ""
let x = 200
let y = 200

function preload()
{
  ml5.setBackend("webgl")
  let options = {probabilityThreshold: 0.7}
  classifier = ml5.soundClassifier("SpeechCommands18w")
}

function setup()
{
  createCanvas(400, 400)
  classifier.classifyStart(gotResults)
}

function draw()
{
  background(220)
  if (predictedWord == "stop")
  {
    circle(x, y, 50)
    x = x
    y = y
```

```
  }
  else if (predictedWord == "up")
  {
    circle(x, y, 50)
    y -= 5
  }
  else if (predictedWord == "down")
  {
    circle(x, y, 50)
    y += 5
  }
  else if (predictedWord == "left")
  {
    circle(x, y, 50)
    x -= 5
  }
  else if (predictedWord == "right")
  {
    circle(x, y, 50)
    x += 5
  }
  else
  {
    circle(x, y, 50)
  }
  edges()
}

function gotResults(results)
{
  predictedWord = results[0].label
}
```

```
function edges()
{
  if (x > width)
  {
    x = 0
  }
  if (x < 0)
  {
    x = width
  }
  if (y > height)
  {
    y = 0
  }
  if (y < 0)
  {
    y = height
  }
}
```

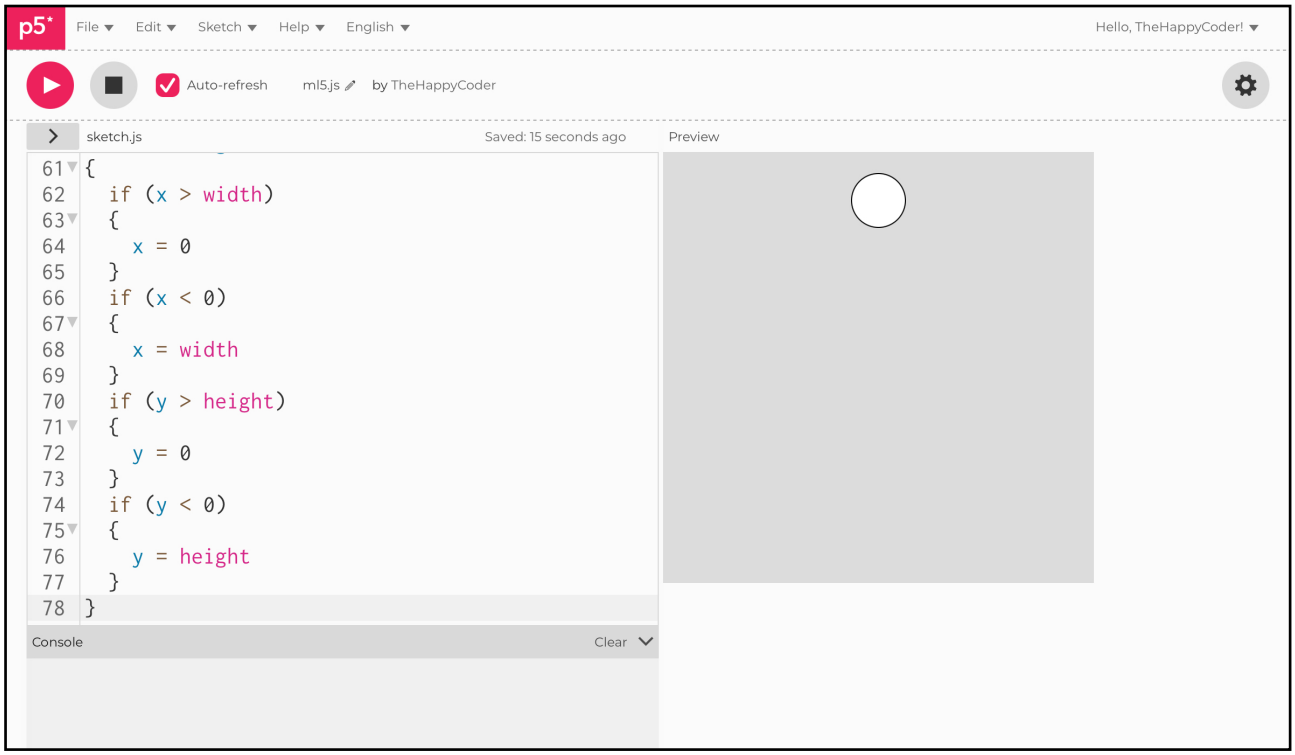
🗒️ Notes

You should be able to move the circle around with your voice. there are quite a few lines of code but does not require much typing. The `edge()` function is standard in most games so that the object stays somewhere on the canvas. It is pretty self evident.

🌻 Challenge

You could change the `edges()` function so that it stops at the edge rather than reappear on the opposite edge.

Figure B5.5


p5*
File
Edit
Sketch
Help
English
Hello, TheHappyCoder!
Auto-refresh
ml5.js
by TheHappyCoder
sketch.js
Saved: 15 seconds ago
Preview
61 {
62 if (x > width)
63 {
64 x = 0
65 }
66 if (x < 0)
67 {
68 x = width
69 }
70 if (y > height)
71 {
72 y = 0
73 }
74 if (y < 0)
75 {
76 y = height
77 }
78 }
Console
Clear

Sketch B5.6 a splash of colour and text

Adding a splash of colour and the text returns on the canvas

```
let classifier
let predictedWord = ""
let x = 200
let y = 200

function preload()
{
  ml5.setBackend("webgl")
  let options = {probabilityThreshold: 0.7}
  classifier = ml5.soundClassifier("SpeechCommands18w")
}

function setup()
{
  createCanvas(400, 400)
  classifier.classifyStart(gotResults)
}

function draw()
{
  background(220, 0, 200)
  if (predictedWord !== "")
  {
    fill(0)
    textAlign(CENTER, CENTER)
    textSize(64)
    text(predictedWord, width/2, height/2)
  }
  fill(200, 200, 10)
```

```
  noStroke()
  if (predictedWord == "stop")
  {
    circle(x, y, 50)
    x = x
    y = y
  }
  else if (predictedWord == "up")
  {
    circle(x, y, 50)
    y -= 5
  }
  else if (predictedWord == "down")
  {
    circle(x, y, 50)
    y += 5
  }
  else if (predictedWord == "left")
  {
    circle(x, y, 50)
    x -= 5
  }
  else if (predictedWord == "right")
  {
    circle(x, y, 50)
    x += 5
  }
  else
  {
    circle(x, y, 50)
  }
  edges()
}
```

```
function gotResults(results)
{
  predictedWord = results[0].label
}

function edges()
{
  if (x > width)
  {
    x = 0
  }
  if (x < 0)
  {
    x = width
  }
  if (y > height)
  {
    y = 0
  }
  if (y < 0)
  {
    y = height
  }
}
```

🗒️ Notes

The accuracy will be the same, which is not great in my case, you may have better results. The accuracy will be affected by background noise, the quality of your microphone and possibly your accent amongst other things. Have a bit of fun with it.

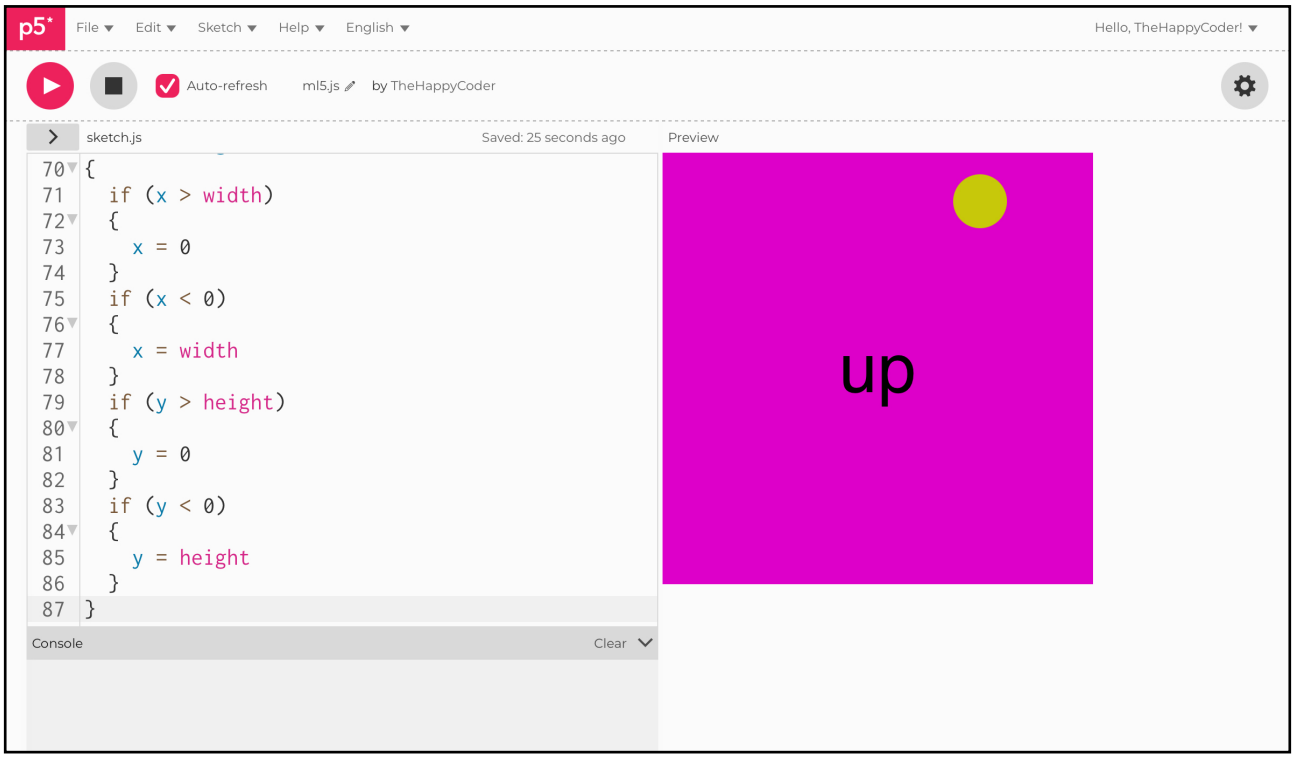
🌻 Challenge

1. Try changing the `probabilityThreshold` value
2. What could you do with the numbers?
3. Could you filter out the words you don't want

🛠️ Code Explanation

`if (predictedWord !== "")`	If there is NOT an empty string, in other words there IS a word it recognises

Figure B5.6


p5*
File
Edit
Sketch
Help
English
Hello, TheHappyCoder!
Auto-refresh
ml5.js
by TheHappyCoder
sketch.js
Saved: 25 seconds ago
Preview
70 {
71 if (x > width)
72 {
73 x = 0
74 }
75 if (x < 0)
76 {
77 x = width
78 }
79 if (y > height)
80 {
81 y = 0
82 }
83 if (y < 0)
84 {
85 y = height
86 }
87 }
Console
Clear
up