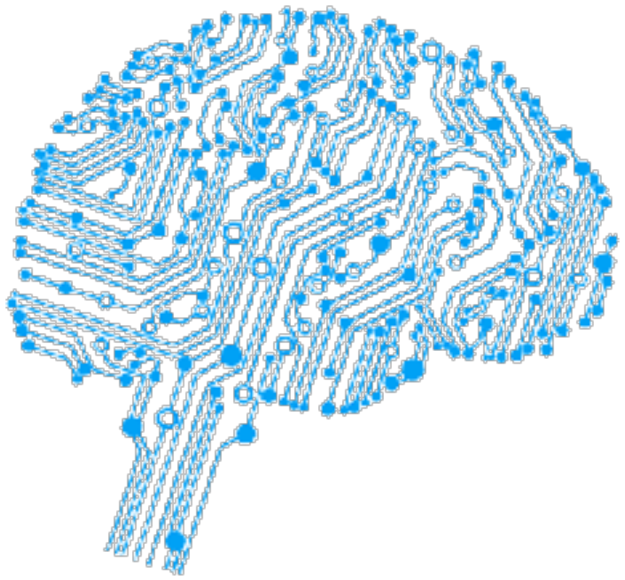


Intro to Machine Learning

MasseyHacks 2017

Deep Blue

- AI computer program built to play Chess
- Programmed for one purpose only

Deep Blue at the computer history museum

AlphaGo

- Machine learning algorithm that plays the board game “Go”
- Excelled in the Go world championship in 2016
- Same algorithm could be taught to play Atari games

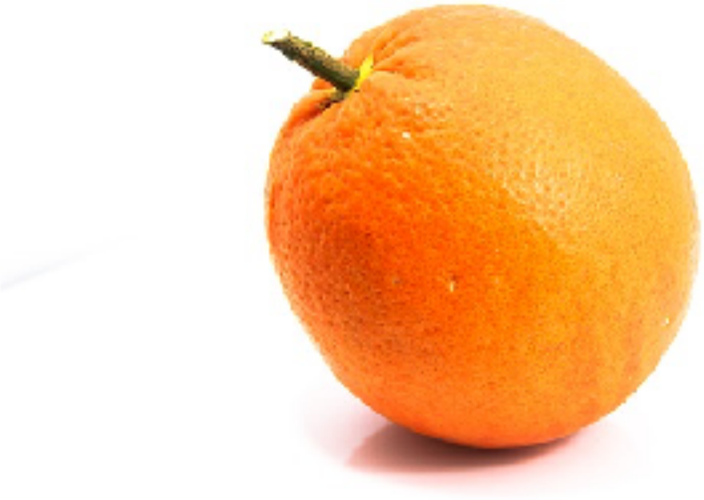
AlphaGo playing Go against Lee Sedol - a world champion

Machine Learning:

Machine learning is the subfield of computer science that gives "computers the ability to learn without being explicitly programmed."

The Problem

- How would you write a program to tell the difference between an apple and an orange?



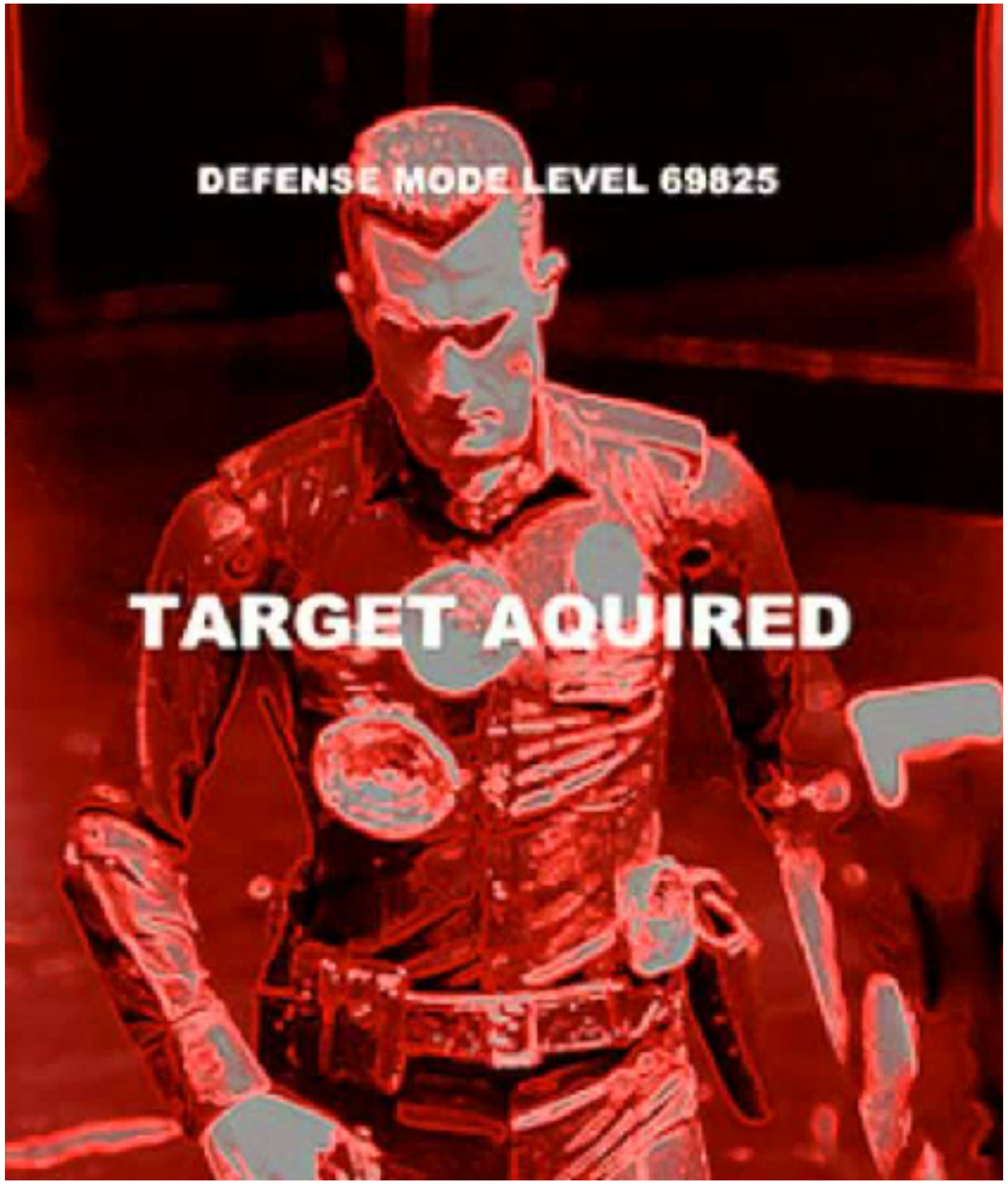
Lots of code

- Too specialized
- Lots of shaky, hard to solve problems to solve
- Not re-usable for other problems

```
def findColors(image):
  # lots of manual checks

def findEdges(image):
  # lots of manual checks

def findShapes(image):
  # lots of manual checks

def determineFruit(image):
  # lots of manual checks

def handleProbability(image):
  # lots of manual checks
```

Classifiers

- One algorithm that can be applied to many problems
- Uses **supervised learning** to use example data to predict the classification of new data



```
import sklearn
```

Training Data

- We need **descriptions** for a fruit, and a **label** to match.
- **Weight** and **texture** are ***features***.
- Good features that effectively discriminate between your data types will make a very accurate classifier

Weight	Texture	Label
140g	Smooth	Apple
130g	Smooth	Apple
150g	Bumpy	Orange
170g	Bumpy	Orange

```python
import sklearn

features = [(140, "smooth"),
    (130, "smooth"),
    (150, "bumpy"),
    (170, "bumpy")]

labels = ["apple", "apple", "orange", "orange"]
```

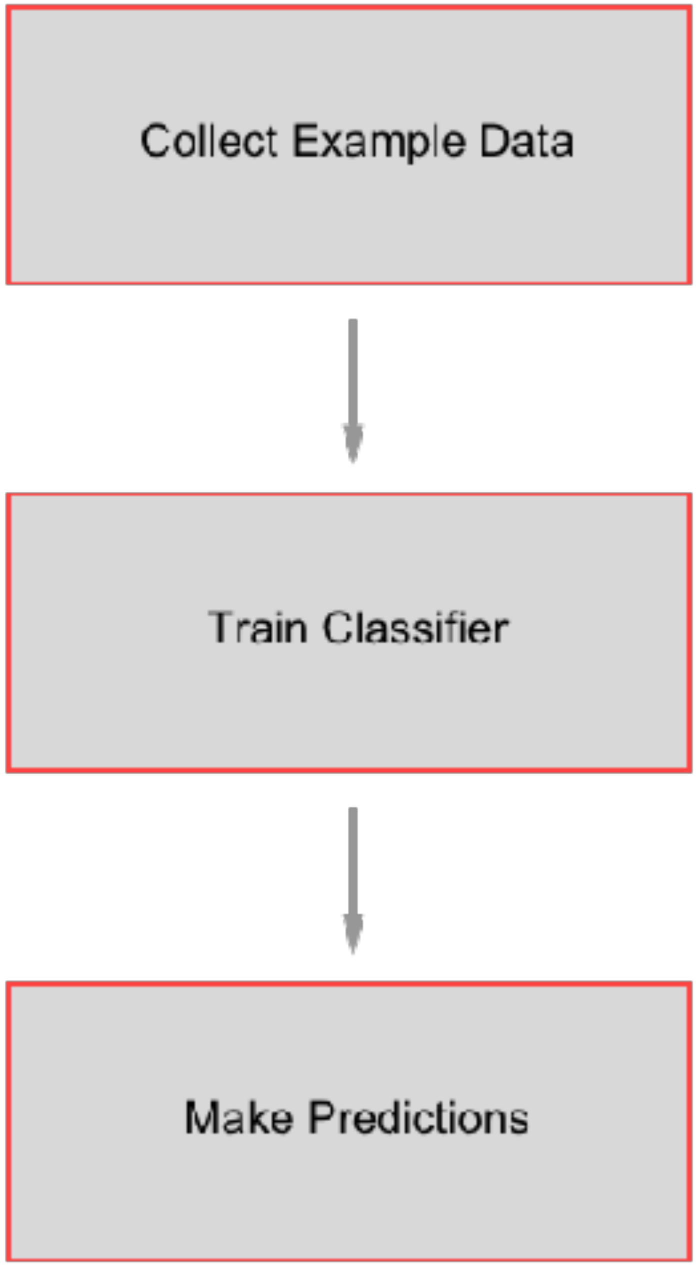
```python
import sklearn

textureSmooth = 0
textureBumpy = 1

labelApple = 0
labelOrange = 1

features = [(140, textureSmooth),
     (130, textureSmooth),
     (150, textureBumpy),
     (170, textureBumpy)]

labels = [labelApple, labelApple, labelOrange, labelOrange]
```

Types of Classifiers

- Decision Tree
- SVM
- Bayesian
- Neural Network
- K Nearest Neighbor
- QLearning
- Genetic Algorithm
- Markov Decision Processes
- Convolutional Neural Networks
- etc.

Decision Trees

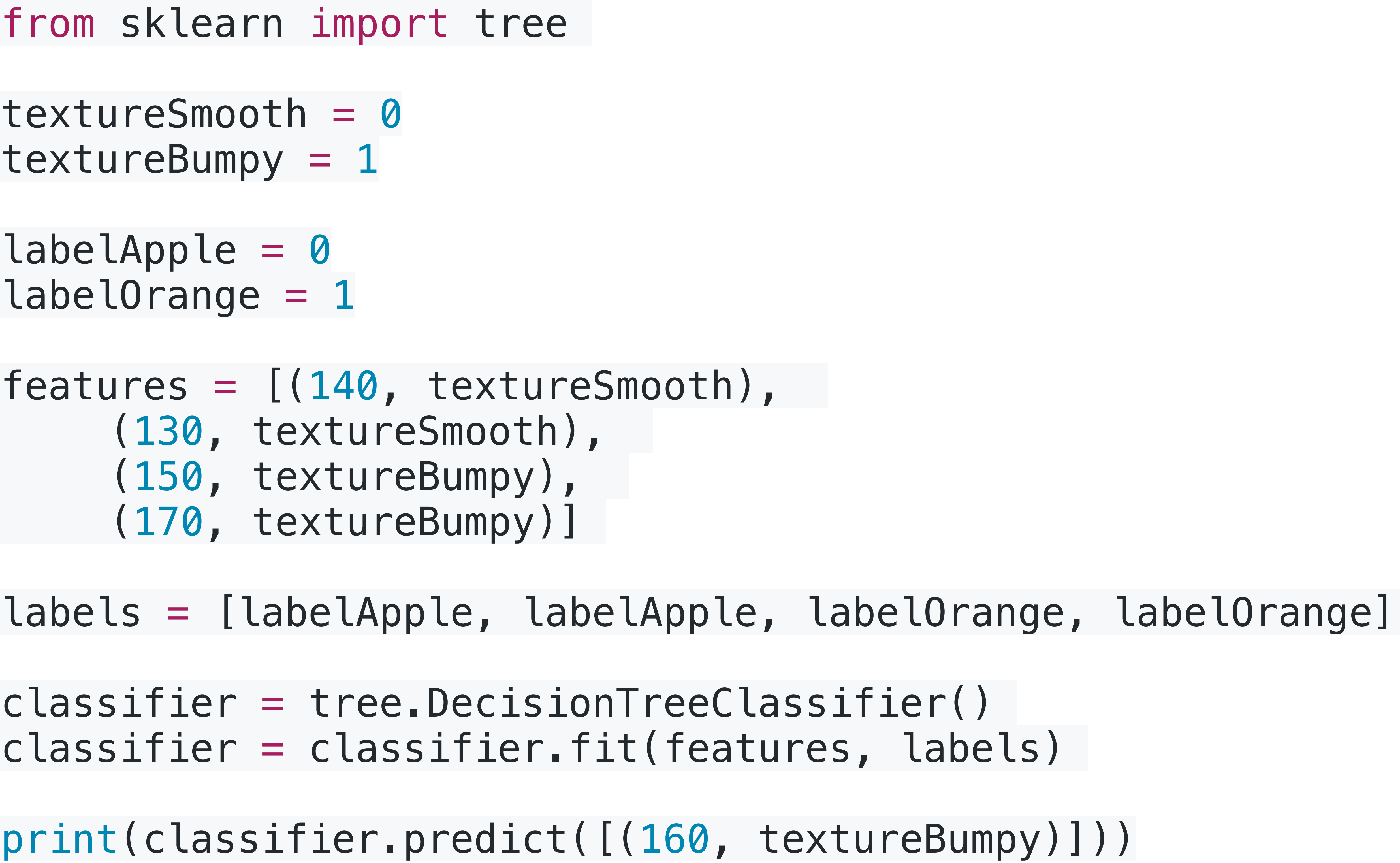
- One of the most basic types of classifiers
- Easy to visualize



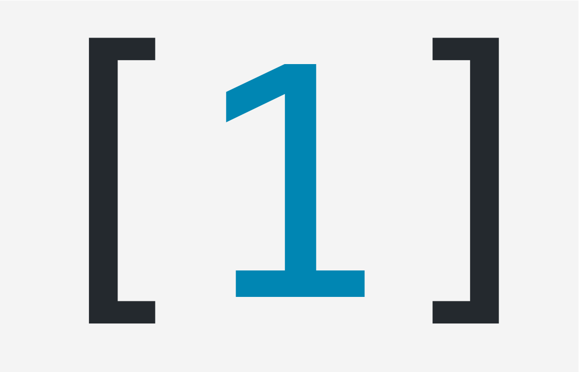
```python
from sklearn import tree

textureSmooth = 0
textureBumpy = 1

labelApple = 0
labelOrange = 1

features = [(140, textureSmooth),
    (130, textureSmooth),
    (150, textureBumpy),
    (170, textureBumpy)]

labels = [labelApple, labelApple, labelOrange,
labelOrange]

classifier = tree.DecisionTreeClassifier()
classifier = classifier.fit(features, labels)
```

What fruit would this be classified as?

```
(160, textureBumpy)
```



```
from sklearn import tree

textureSmooth = 0
textureBumpy = 1

labelApple = 0
labelOrange = 1

features = [(140, textureSmooth),
     (130, textureSmooth),
     (150, textureBumpy),
     (170, textureBumpy)]

labels = [labelApple, labelApple, labelOrange, labelOrange]

classifier = tree.DecisionTreeClassifier()
classifier = classifier.fit(features, labels)

print(classifier.predict([(160, textureBumpy)]))
```



```
[1]
```

Features

- Machine learning classifiers are only as good as the features they use
- Coming up with good features is one of the most important parts of machine learning

What makes a good feature?

- How would you compare greyhounds and labradors?
- What features would you use to discriminate between them?

More Features = Better