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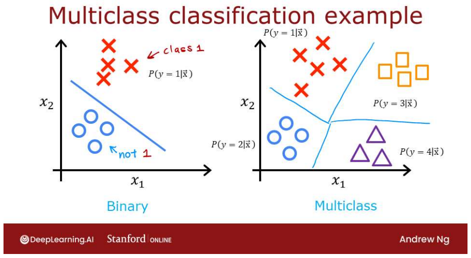
Optional Lab - Multi-class Classification

1.1 Goals

In this lab, you will explore an example of multi-class classification using neural networks.



1.2 Tools

You will use some plotting routines. These are stored in `lab_utils_multiclass_TF.py` in this directory.

In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
%matplotlib widget
from sklearn.datasets import make_blobs
import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
np.set_printoptions(precision=2)
from lab_utils_multiclass_TF import *
import logging
logging.getLogger("tensorflow").setLevel(logging.ERROR)
tf.autograph.set_verbosity(0)
```

2.0 Multi-class Classification

Neural Networks are often used to classify data. Examples are neural networks:

- take in photos and classify subjects in the photos as {dog,cat,horse,other}
- take in a sentence and classify the 'parts of speech' of its elements: {noun, verb, adjective etc..}

A network of this type will have multiple units in its final layer. Each output is associated with a category. When an input example is applied to the network, the output with the highest value is the category predicted. If the output is applied to a softmax function, the output of the softmax will provide probabilities of the input being in each category.

In this lab you will see an example of building a multiclass network in Tensorflow. We will then take a look at how the neural network makes its predictions.

Let's start by creating a four-class data set.

2.1 Prepare and visualize our data

We will use Scikit-Learn `make_blobs` function to make a training data set with 4 categories as shown in the plot below.

In [2]:
```
# make 4-class dataset for classification
classes = 4
m = 100
centers = [[-5, 2], [-2, -2], [1, 2], [5, -2]]
std = 1.0
X_train, y_train = make_blobs(n_samples=m, centers=centers, cluster_std=std,random_state=30)
```

In [3]:
```
plt_mc(X_train,y_train,classes, centers, std=std)
```

```
Canvas(toolbar=Toolbar(toolitems=[('Home', 'Reset original view', 'home', 'home'), ('Back', 'Back to previous …
```

Each dot represents a training example. The axis (x0,x1) are the inputs and the color represents the class the example is associated with. Once trained, the model will be presented with a new example, (x0,x1), and will predict the class.

While generated, this data set is representative of many real-world classification problems. There are several input features (x0,...,xn) and several output categories. The model is trained to use the input features to predict the correct output category.