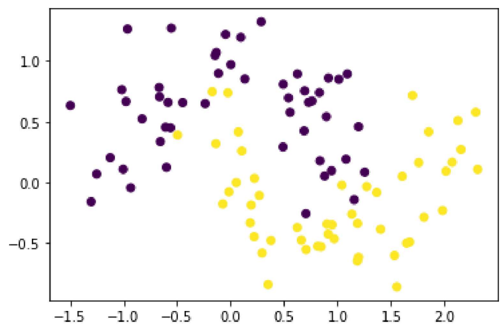
```
import numpy as np
import matplotlib.pyplot as plt
from sklearn.datasets import make_moons
import seaborn as sns
from mlxtend.plotting import plot_decision_regions

import tensorflow
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import Dropout
from tensorflow.keras.optimizers import Adam
```

```
X, y = make_moons(100, noise=0.25,random_state=2)
```

```
import matplotlib.pyplot as plt
plt.scatter(X[:,0], X[:,1], c=y)
plt.show()
```



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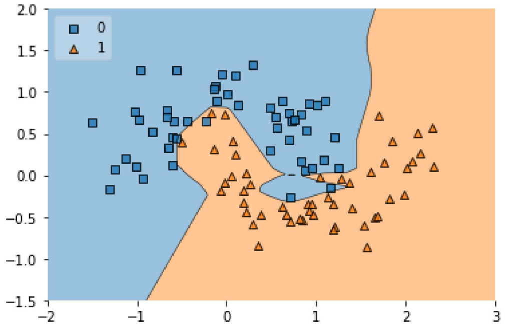
```
model1 = Sequential()

model1.add(Dense(128,input_dim=2, activation="relu"))
model1.add(Dense(128, activation="relu"))
model1.add(Dense(1,activation='sigmoid'))

model1.summary()
```

```
Model: "sequential_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_6 (Dense)             (None, 128)               384

 dense_7 (Dense)             (None, 128)               16512

 dense_8 (Dense)             (None, 1)                 129

=================================================================
Total params: 17,025
Trainable params: 17,025
Non-trainable params: 0
_________________________________________________________________
```

```
adam = Adam(learning_rate=0.01)
model1.compile(loss='binary_crossentropy', optimizer=adam, metrics=['accuracy'])

history1 = model1.fit(X, y, epochs=2000, validation_split = 0.2,verbose=0)
```

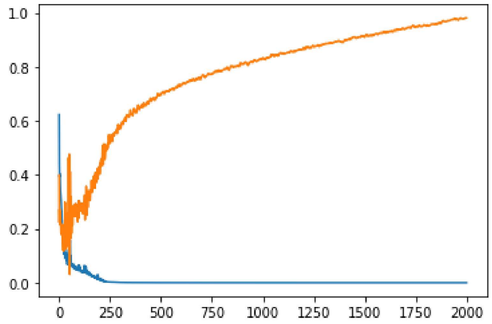
```
plot_decision_regions(X, y.astype('int'), clf=model1, legend=2)
plt.xlim(-2,3)
plt.ylim(-1.5,2)
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/mlxtend/plotting/decision_regions.py:244: Matplot
  ax.axis(xmin=xx.min(), xmax=xx.max(), y_min=yy.min(), y_max=yy.max())
```



```
plt.plot(history1.history['loss'])
plt.plot(history1.history['val_loss'])
```

```
[<matplotlib.lines.Line2D at 0x7f042d0f3210>]
```



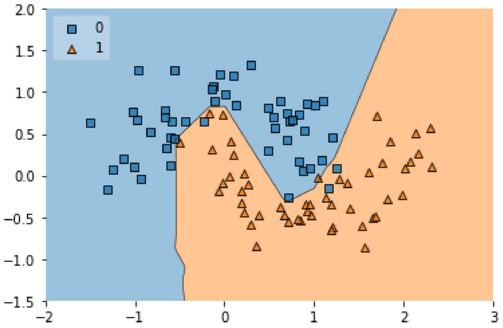
```
model2 = Sequential()

model2.add(Dense(128,input_dim=2, activation="relu",kernel_regularizer=tensorflow.keras.regularizers.l1(0.001)))
model2.add(Dense(128, activation="relu",kernel_regularizer=tensorflow.keras.regularizers.l1(0.001)))
model2.add(Dense(1,activation='sigmoid'))

model2.summary()
```

```
Model: "sequential_7"

 Layer (type)                Output Shape              Param #
=================================================================
 dense_21 (Dense)            (None, 128)               384

 dense_22 (Dense)            (None, 128)               16512

 dense_23 (Dense)            (None, 1)                 129

=================================================================
Total params: 17,025
Trainable params: 17,025
Non-trainable params: 0
```

```
adam = Adam(learning_rate=0.01)
model2.compile(loss='binary_crossentropy', optimizer=adam, metrics=['accuracy'])

history2 = model2.fit(X, y, epochs=2000, validation_split = 0.2,verbose=0)
```

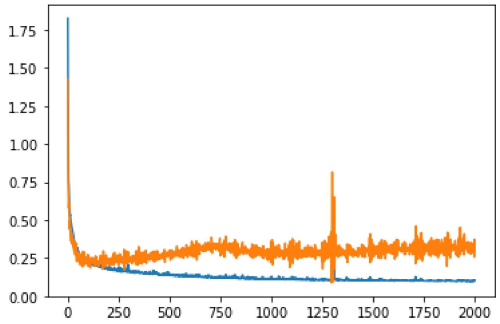
```
plot_decision_regions(X, y.astype('int'), clf=model2, legend=2)
plt.xlim(-2,3)
plt.ylim(-1.5,2)
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/mlxtend/plotting/decision_regions.py:244: Matplot
  ax.axis(xmin=xx.min(), xmax=xx.max(), y_min=yy.min(), y_max=yy.max())
```



```
plt.plot(history2.history['loss'])
plt.plot(history2.history['val_loss'])
```

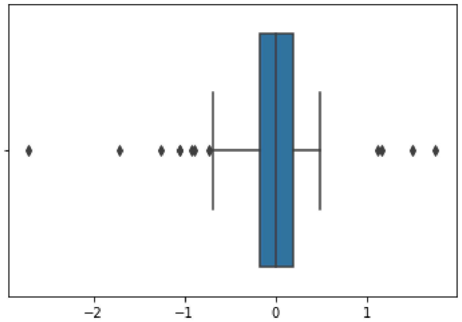
```
[<matplotlib.lines.Line2D at 0x7f042209ba10>]
```



```
model1_weight_layer1 = model1.get_weights()[0].reshape(256)
model2_weight_layer1 = model2.get_weights()[0].reshape(256)
```

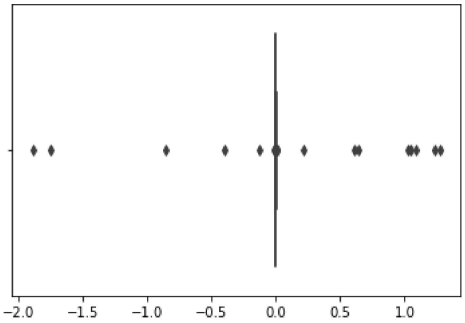
```
sns.boxplot(model1_weight_layer1)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass th
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f04220b8b10>
```



```
sns.boxplot(model2_weight_layer1)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/_decorators.py:43: FutureWarning: Pass th
  FutureWarning
<matplotlib.axes._subplots.AxesSubplot at 0x7f042202c390>
```



```
model1_weight_layer1.min()
```

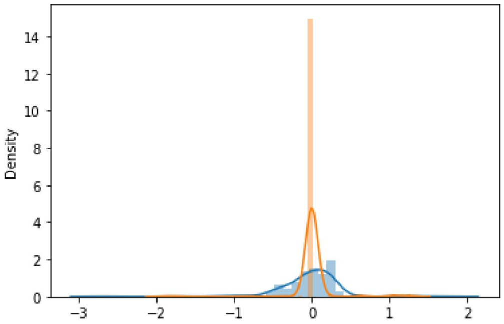
```
-2.7185578
```

```
model2_weight_layer1.min()
```

```
-1.8934479
```

```
sns.distplot(model1_weight_layer1)
sns.distplot(model2_weight_layer1)
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarning: `di
  warnings.warn(msg, FutureWarning)
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarning: `di
  warnings.warn(msg, FutureWarning)
<matplotlib.axes._subplots.AxesSubplot at 0x7f0422018610>
```



```
model1.get_weights()[0].reshape(256)
```

```
array([ 8.36581886e-02,  3.62687036e-02, -4.17765856e-01, -3.93163204e-01,
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        2.23829538e-01,  1.97904125e-01, -5.38365006e-01,  1.70224056e-01,
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        4.95364517e-02,  8.23249444e-02, -5.02141356e-01, -1.56526896e-03,
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       -2.12982274e-03,  2.03352317e-01,  1.95124984e-01, -5.25625683e-02,
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       -2.26653010e-01,  2.15190932e-01,  2.18419120e-01,  9.44057107e-02,
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```