In [ ]:
```python
## Import Some Libraries
import json
import numpy as np
import networkx as nx
import matplotlib.pyplot as plt
```

In [ ]:
```python
class LoadModel:
    def __init__(self, file_path):
        with open(file_path, 'r') as f:
            model_data = json.load(f)

        layers = model_data['layers']
        n_layers = len(layers)

        self.weights = []
        self.biases = []
        self.activations = []

        for i in range(1, n_layers):
            layer = layers[i]

            if layer['tipe'] == 'hidden':
                n_neurons = layer['n_neuron']
                weight = np.array(layer['weight'])
                bias = np.array(layer['bias'])
                activation = layer['activation_function']

                self.weights.append(weight)
                self.biases.append(bias)
                self.activations.append(activation)

            elif layer['tipe'] == 'output':
                n_neurons = layer['n_neuron']
                weight = np.array(layer['weight'])
                bias = np.array(layer['bias'])
                activation = layer['activation']

                self.weights.append(weight)
                self.biases.append(bias)
                self.activations.append(activation)

    def get_weights(self):
        return self.weights

    def get_biases(self):
        return self.biases

    def get_activations(self):
        return self.activations

    def get_layer(self, layer):
        return self.weights[layer], self.biases[layer], self.activations[layer]

    def get_layer_weights(self, layer):
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        return self.weights[layer]

    def get_layer_biases(self, layer):
        return self.biases[layer]

    def get_layer_activations(self, layer):
        return self.activations[layer]

    def get_model(self):
        return self.weights, self.biases, self.activations

    # print model per layer
    def print_model(self):
        for i in range(len(self.weights)):
            print('Layer', i+1)
            print('Weights:', self.weights[i])
            print('Biases:', self.biases[i])
            print('Activations:', self.activations[i])
            print('')
```

In [ ]:

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class FFNN:
    def __init__(self, model_path):
        self.model = LoadModel(model_path)
        self.weights = self.model.get_weights()
        self.biases = self.model.get_biases()
        self.activations = self.model.get_activations()

    def forward_propagation(self, X):
        input_layer = X
        n_layers = len(self.weights) + 1
        for i in range(n_layers - 1):
            dot_product = np.dot(input_layer, self.weights[i]) + self.biases[i]
            if self.activations[i] == 'relu':
                output_layer = np.maximum(0, dot_product)
            elif self.activations[i] == 'sigmoid':
                output_layer = 1 / (1 + np.exp(-dot_product))
            elif self.activations[i] == 'linear':
                output_layer = dot_product
            elif self.activations[i] == 'softmax':
                output_layer = np.exp(dot_product) / np.sum(np.exp(dot_product), ax
            input_layer = output_layer

            print(f'Layer {i + 1} Calculated: {output_layer}')
        print()

        return output_layer

    def predict(self, X):
        if len(X.shape) == 1:
            return self.forward_propagation(X)
        else:
            predictions = []
            for instance in X:
                print(f'Instance: {instance}')
                predictions.append(self.forward_propagation(instance))
            return np.array(predictions)
```

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    def accuracy(self, X, y_true):
        y_pred = self.predict(X)
        y_pred = (y_pred >= 0.5).astype(int)

        print(f'Predictions: {y_pred}')
        #print(f'True Labels: {y_true}\n')

        return np.mean(y_pred == y_true)

    def sum_squared_error(self, y_calc, y_true):
        return np.sum(np.square(y_true - y_calc))

    def print_model(self):
        self.model.print_model()

    def draw_network(self):
        G = nx.DiGraph()

        pos = {}

        # add nodes
        input_nodes = [f'X_{i + 1}' for i in range(len(self.weights[0]))]
        G.add_nodes_from(input_nodes, layer='Input')
        G.add_nodes_from(['b0'], layer='Bias')
        for i in range(len(input_nodes)):
            pos[f'X_{i + 1}'] = [0, i + 1]
        pos['b0'] = [0, len(self.weights[0]) + 1]

        hidden_nodes = []

        for i in range(len(self.weights) - 1):
            hidden_nodes.append([f'h{i + 1}_{j + 1}' for j in range(len(self.weight
            G.add_nodes_from(hidden_nodes[i], layer='Hidden')
            G.add_nodes_from([f'b{i + 1}'], layer='Bias')
            for j in range(len(hidden_nodes[i])):
                pos[f'h{i + 1}_{j + 1}'] = [i + 1, j + 1]
            pos[f'b{i + 1}'] = [i + 1, len(self.weights[i][0]) + 1]

        output_nodes = [f'y_{i + 1}' for i in range(len(self.weights[-1][0]))]
        G.add_nodes_from(output_nodes, layer='Output')
        for i in range(len(output_nodes)):
            pos[f'y_{i + 1}'] = [len(self.weights), i + 1]

        # add edges

        # for one layer models
        if len(self.weights) == 1 :
            for j in range(len(self.weights[0])):
                for k in range(len(self.weights[0][j])):
                    G.add_edge(input_nodes[j], output_nodes[k], weight=self.weights
                    G.add_edge(f'b0', output_nodes[k], weight=self.biases[0][k])

        else: # for multiple layer models
            for i in range(len(self.weights)):
                for j in range(len(self.weights[i])):
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                    for k in range(len(self.weights[i][j])):
                        if i == 0:
                            G.add_edge(input_nodes[j], hidden_nodes[i][k], weight=s
                            G.add_edge(f'b0', hidden_nodes[i][k], weight=self.biase
                        elif i == len(self.weights) - 1:
                            G.add_edge(hidden_nodes[i - 1][j], output_nodes[k], wei
                            G.add_edge(f'b{i}', output_nodes[k], weight=self.biases
                        else:
                            G.add_edge(hidden_nodes[i - 1][j], hidden_nodes[i][k],
                            G.add_edge(f'b{i}', hidden_nodes[i][k], weight=self.bia

        # draw network
        edge_labels = nx.get_edge_attributes(G, 'weight')

        nx.draw_networkx_nodes(G, pos, node_size=1500, node_color='lightblue')
        nx.draw_networkx_edges(G, pos, width=2, edge_color='black', arrows=True, ar
        nx.draw_networkx_edge_labels(G, pos, edge_labels=edge_labels, label_pos=0.6
        nx.draw_networkx_labels(G, pos, font_size=12, font_family='sans-serif')
        plt.axis('off')
        plt.show()


# main function
def main():
    # load model
    filename = input("Enter the filename: ")
    model_path = filename + '.json'
    model = FFNN(model_path)

    # visualize input layer

    # linear
    #X = np.array([[3.0, 1.0]])
    #y_true = np.array([0])

    # relu
    # X = np.array([[-1.0, 0.5]])
    # y_true = np.array([0])

    # sigmoid
    # X = np.array([[0.2, 0.4]])
    # y_true = np.array([1])

    # softmax
    # X = np.array([[1.0, 2.0]])
    # y_true = np.array([1])

    # multilayer
    X = np.array([[1.0, 0.0], [0.0, 1.0], [0.0, 0.0]])
    y_true = np.array([1, 1, 1])

    # calculate accuracy
    accuracy = model.accuracy(X, y_true)

    model.draw_network()
```

```
    # # print predictions and accuracy
    print('Accuracy: {:.2f}%'.format(accuracy*100))

if __name__ == '__main__':
    main()
```

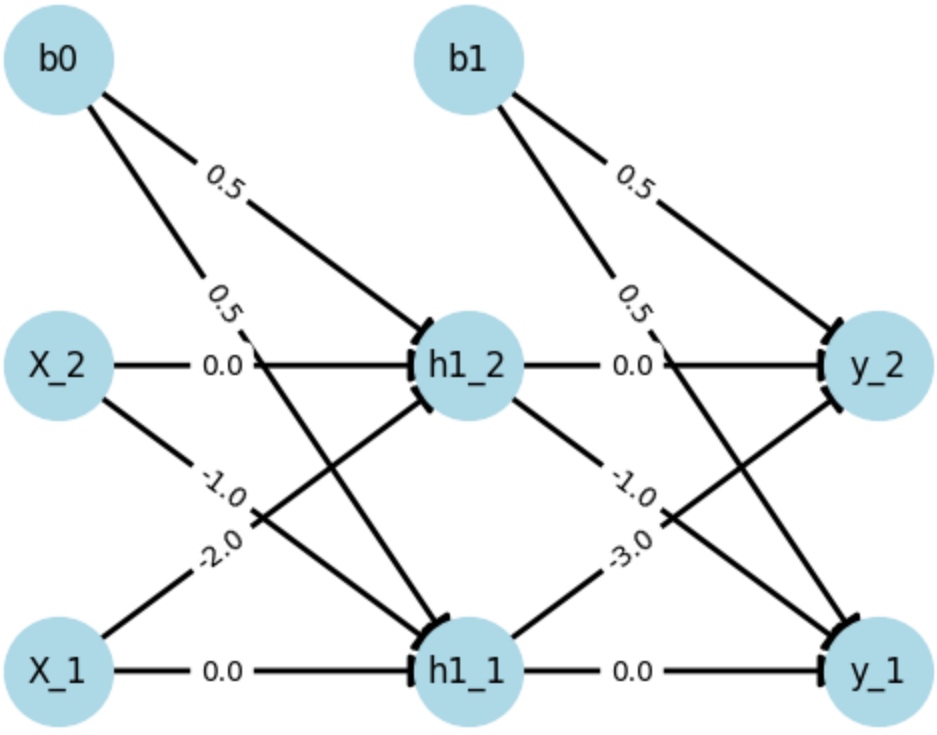
```
Enter the filename: multilayer
Instance: [1. 0.]
Layer 1 Calculated: [ 0.5 -1.5]
Layer 2 Calculated: [2. 0.]

Instance: [0. 1.]
Layer 1 Calculated: [-0.5  0.5]
Layer 2 Calculated: [0. 2.]

Instance: [0. 0.]
Layer 1 Calculated: [0.5 0.5]
Layer 2 Calculated: [0. 0.]

Predictions: [[1 0]
 [0 1]
 [0 0]]
```

```
/var/folders/dc/fhzs5jcn6yqcmgmf2wkj5pk80000gn/T/ipykernel_28407/1539323777.py:45: D
eprecationWarning: elementwise comparison failed; this will raise an error in the fu
ture.
  return np.mean(y_pred == y_true)
```

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Accuracy: 0.00%
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