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# Representing Neural Networks: Takeaways

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## Syntax

- Generating data with specific properties using scikit learn:
  - sklearn.datasets.make regression()
  - sklearn.datasets.make classification()
  - sklearn.datasets.make moons()
- Generating a regression dataset with 3 features, 1000 observations, and a random seed of 1:

```
from sklearn.datasets import make_regression

data = make_regression(n_samples=1000, n_features=3, random_state=1)
```

• Returning a tuple of two NumPy objects that contain the generated data:

```
print(type(data))
tuple
```

• Retrieving the features of the generated data:

```
print(data[0])
array([[ 0.93514778,     1.81252782,     0.14010988],
        [-3.06414136,     0.11537031,     0.31742716],
        [-0.42914228,     1.20845633,     1.1157018 ],
        ...,
        [-0.42109689,     1.01057371,     0.20722995],
        [ 2.18697965,     0.44136444, -0.10015523],
        [ 0.440956 ,     0.32948997, -0.29257894]])
```

• Retrieving the first row of data:

```
print(data[0][0])
array([ 0.93514778,  1.81252782,  0.14010988])
```

• Retrieving the labels of the data:

• Retrieving the first label of the data:

```
print(data[1][0])
255.52134901495128
```

• Creating a DataFrame:

```
features = pd.DataFrame(data[0])
```

### Concepts

- We usually represent Nneural networks as **graphs**. A graph is a data structure that consists of nodes (represented as circles) connected by edges (represented as lines between the nodes).
- Graphs are a highly flexible data structure; you can even represent a list of values as a graph. We often categorize graphs according to their properties, which act as constraints. You can read about the many different ways to categorize graphs <u>at Wikipedia</u>.
- We represent neural network models as a **computational graph**. A computational graph uses nodes to describe variables and edges to describe the combination of variables.
- In a simple neural network, we see the following:
  - An input neuron represents each feature column in a dataset
  - Each weight value is represented as an arrow from the feature column it multiples to the **output neuron**
- Inspired by biological neural networks, an **activation function** determines if the neuron *fires* or not. In a neural network model, the activation function transforms the weighted sum of the input values.

#### Resources

- Graph Theory on Wikipedia
- Directed Acyclic Graph on Wikipedia
- Feedforward Neural Network on Wikipedia
- Calculus on Computational Graphs
  - Explores how to use computational graphs to organize derivatives.

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