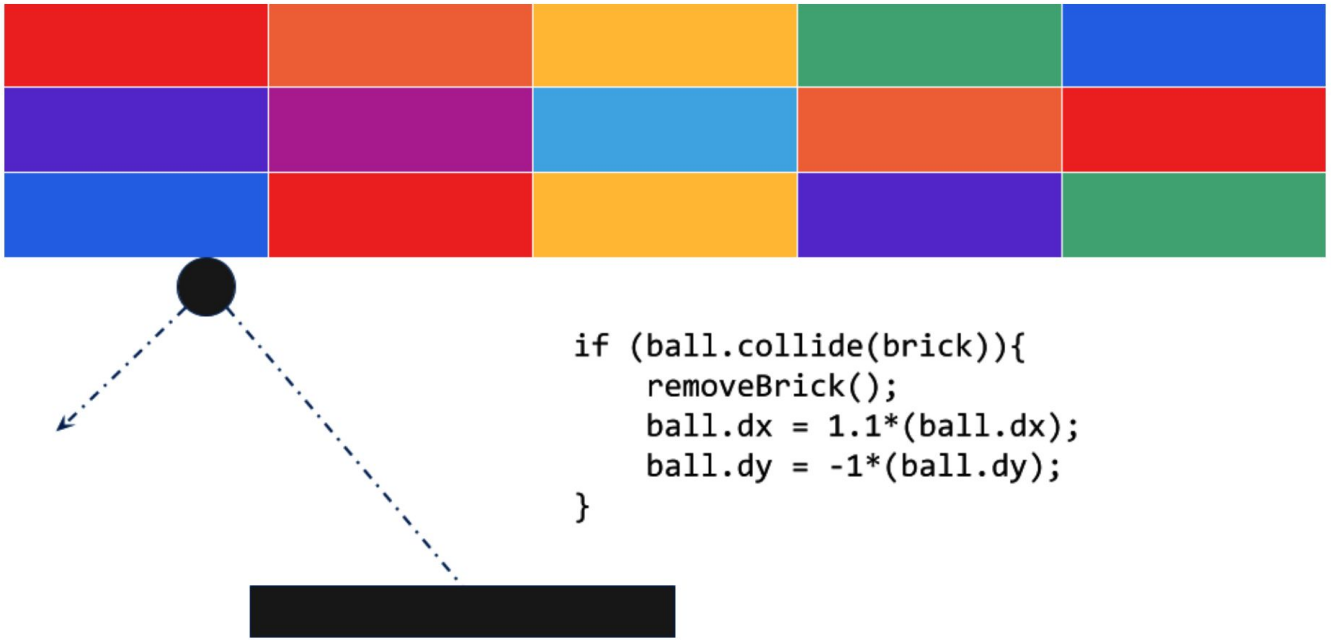
Machine Learning

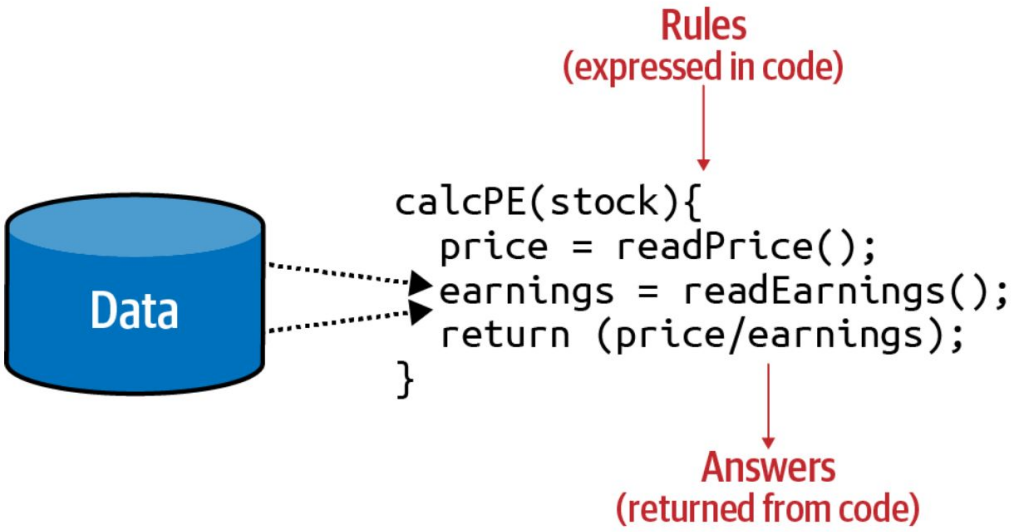
What is Machine Learning?

Traditional Programming



```
if (ball.collide(brick)){
    removeBrick();
    ball.dx = 1.1*(ball.dx);
    ball.dy = -1*(ball.dy);
}
```

Traditional Programming



Traditional Programming

Limitations Traditional Programming

```
if(speed<4){
    status=WALKING;
}
```

Limitations Traditional Programming

```
if(speed<4){
    status=WALKING;
} else {
    status=RUNNING;
}
```

Limitations Traditional Programming

```
if(speed<4){
    status=WALKING;
} else if(speed<12){
    status=RUNNING;
} else {
    status=BIKING;
}
```

Limitations Traditional Programming

```
// ???
```

From Programming to Learning

From Programming to Learning

From Programming to Learning

```
0101001010100101010
1001010101001011101
0100101010010101001
0101001010100101010
```

Label = WALKING

```
1010100101001010101
0101010010010010001
0010011111010101111
1010100100111101011
```

Label = RUNNING

```
1001010011111010101
1101010111010101110
1010101111010101011
1111110001111010101
```

Label = BIKING

```
1111111111010011101
0011111010111110101
0101110101010101110
1010101010100111110
```

Label = GOLFING

Machine Learning

- **Supervised Learning** - is a machine learning approach that's defined by its use of labeled datasets.
- **Unsupervised Learning** - uses machine learning algorithms to analyze and cluster unlabeled data sets.
- **Reinforcement Learning** - is a machine learning training method based on rewarding desired behaviors and punishing undesired ones. In general, a reinforcement learning agent -- the entity being trained -- is able to perceive and interpret its environment, take actions and learn through trial and error.

Supervised Learning

- **Regression**
  - Linear Regression
  - Logistic Regression
  - Polynomial Regression
- **Classification**
  - *Linear Classifier*
  - Support Vector Machines
  - Decision Trees
  - Random Forest

Unsupervised Learning

- Clustering
- Association

Reinforcement Learning

- Robotics
- Self-driving cars