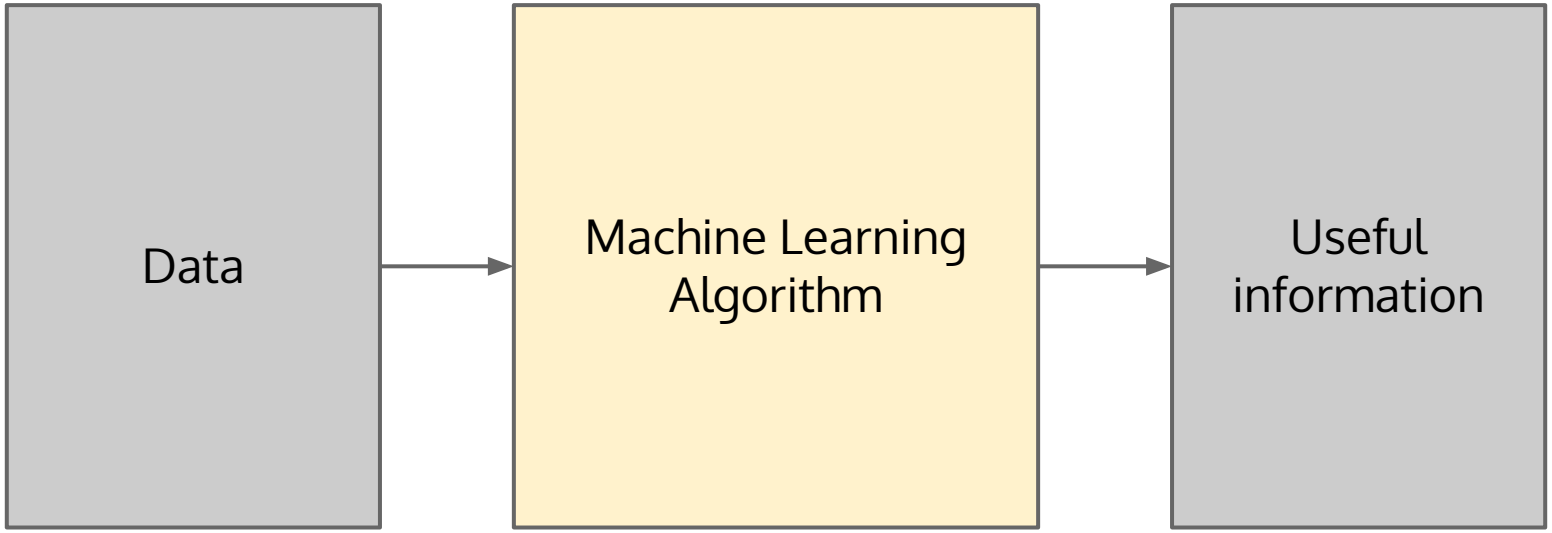
Machine Learning

What is Machine Learning?



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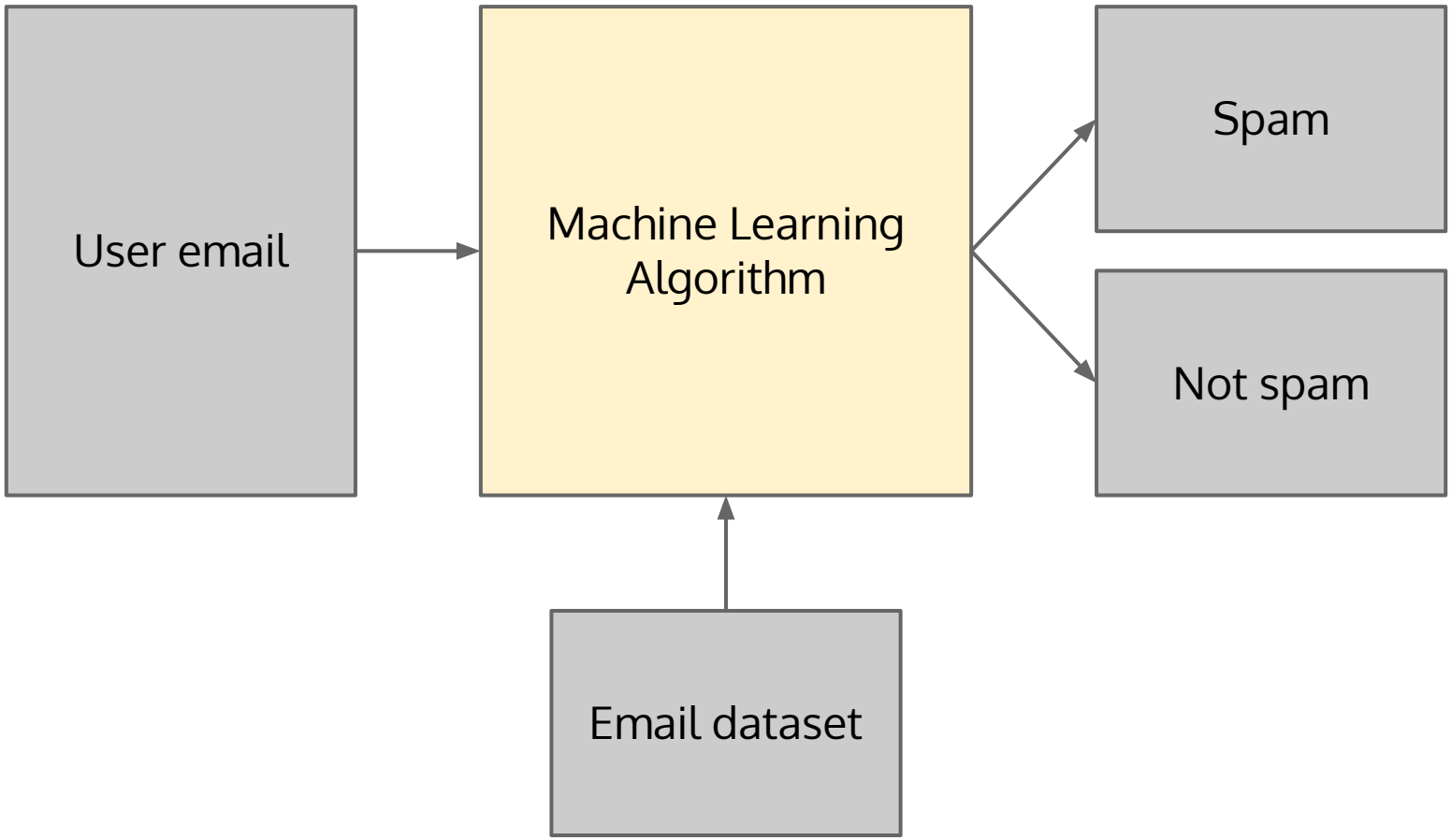


An Example

- Jack
  - Single
  - 20 years old
  - Favorite TV shows:
    - Game of Thrones
    - Suits
    - The Big Bang Theory

- You work in XYZ Network, and you want to know:
  - Will Jack like South Park?

An Example

```
def recommendSouthPark(user):
    score = 0
    if 15 <= user.age < 25:    score += 10
    elif 25 <= user.age < 35:  score += 5
    elif user.age <= 35:       score += 2
    else:                      score -= 5

    if user.isSingle:          score += 5
    else:                      score -= 5

    return score > 0
```

With Machine Learning…

```
def recommendSouthPark(user):
    recommendation = machineLearningMagic(user)
    return recommendation
```

Unravelling the Magic

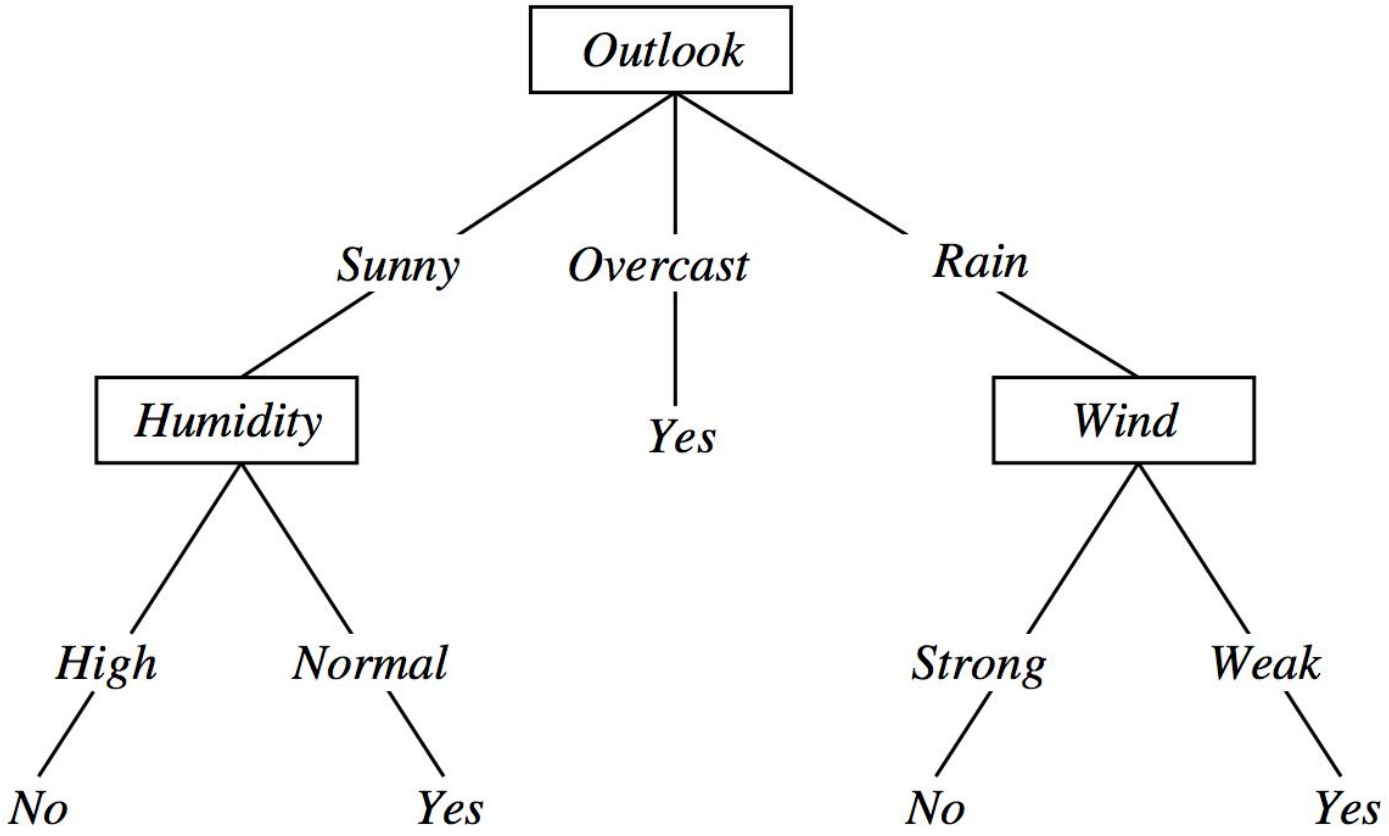
- How can we make better recommendations?
  - Find the closest user
  - Find k-closest users
  - Find the closest TV show that matches user's favorites
- Simple ML algorithms do those!
  - e.g. k-Nearest Neighbors algorithm

Decision Trees

What are Decision Trees?

- Should I play tennis today?
  - Outlook: Sunny, Overcast, Rain
  - Temperature: Hot, Mild, Cool
  - Humidity: High, Normal
  - Wind: Weak, Strong

What are Decision Trees?



Should I play tennis today?

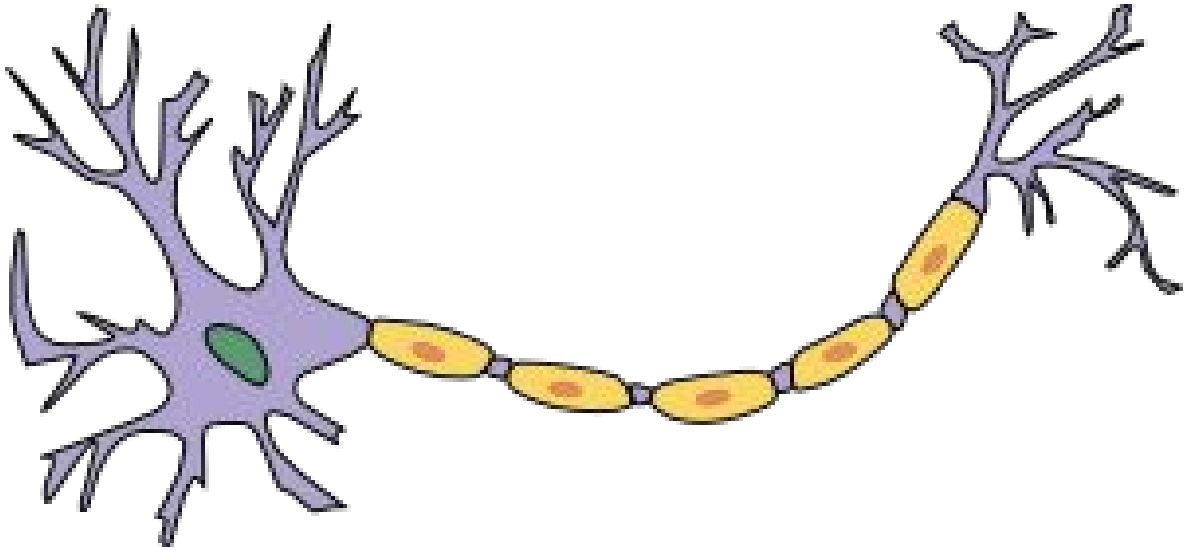
Day	Outlook	Temperature	Humidity	Wind	PlayTennis
D1	Sunny	Hot	High	Weak	No
D2	Sunny	Hot	High	Strong	No
D3	Overcast	Hot	High	Weak	Yes
D4	Rain	Mild	High	Weak	Yes
D5	Rain	Cool	Normal	Weak	Yes
D6	Rain	Cool	Normal	Strong	No
D7	Overcast	Cool	Normal	Strong	Yes
D8	Sunny	Mild	High	Weak	No
D9	Sunny	Cool	Normal	Weak	Yes
D10	Rain	Mild	Normal	Weak	Yes
D11	Sunny	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High	Strong	No

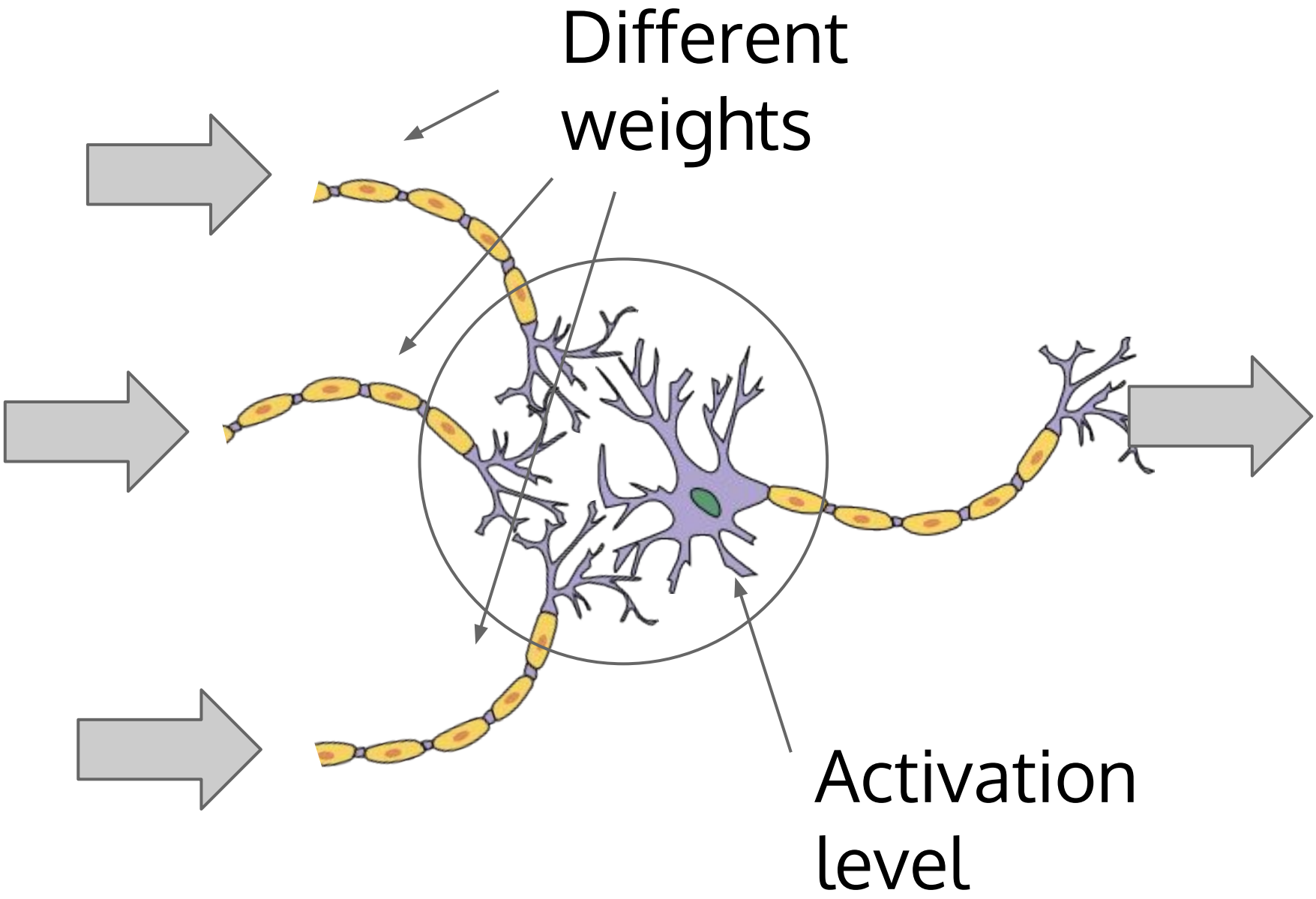
Where Does ML Come In?

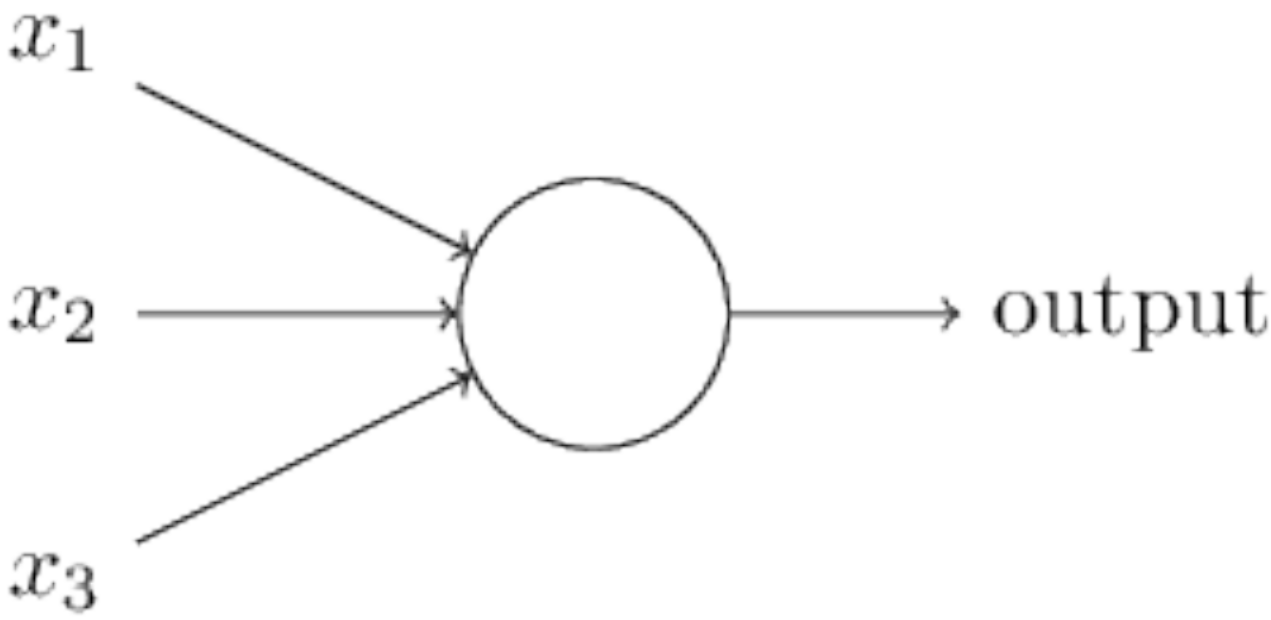
- Learn the labels!
- Choose what questions to ask!

Neural Networks

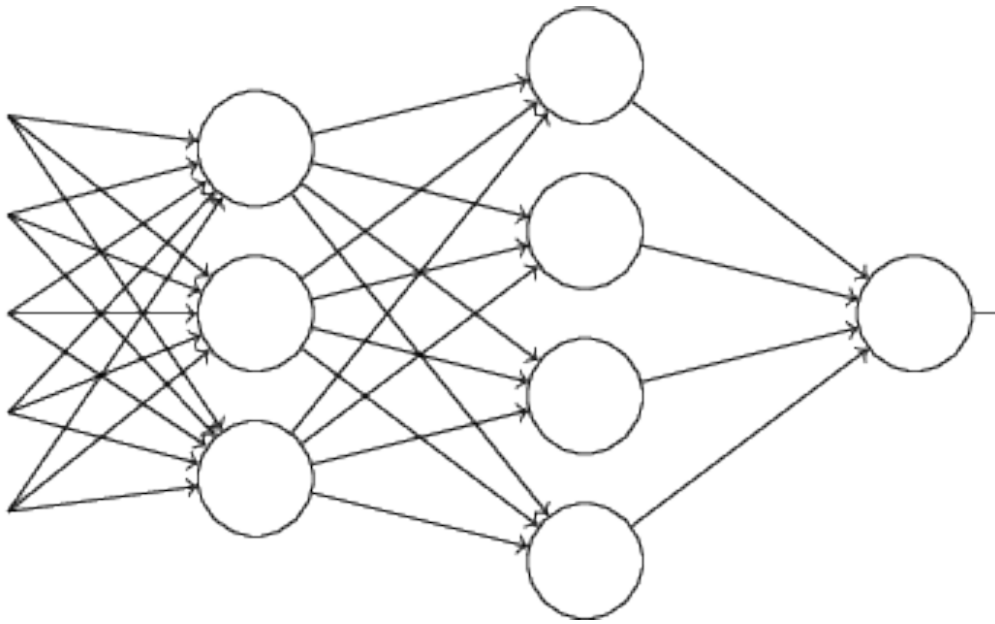
What is a neuron?



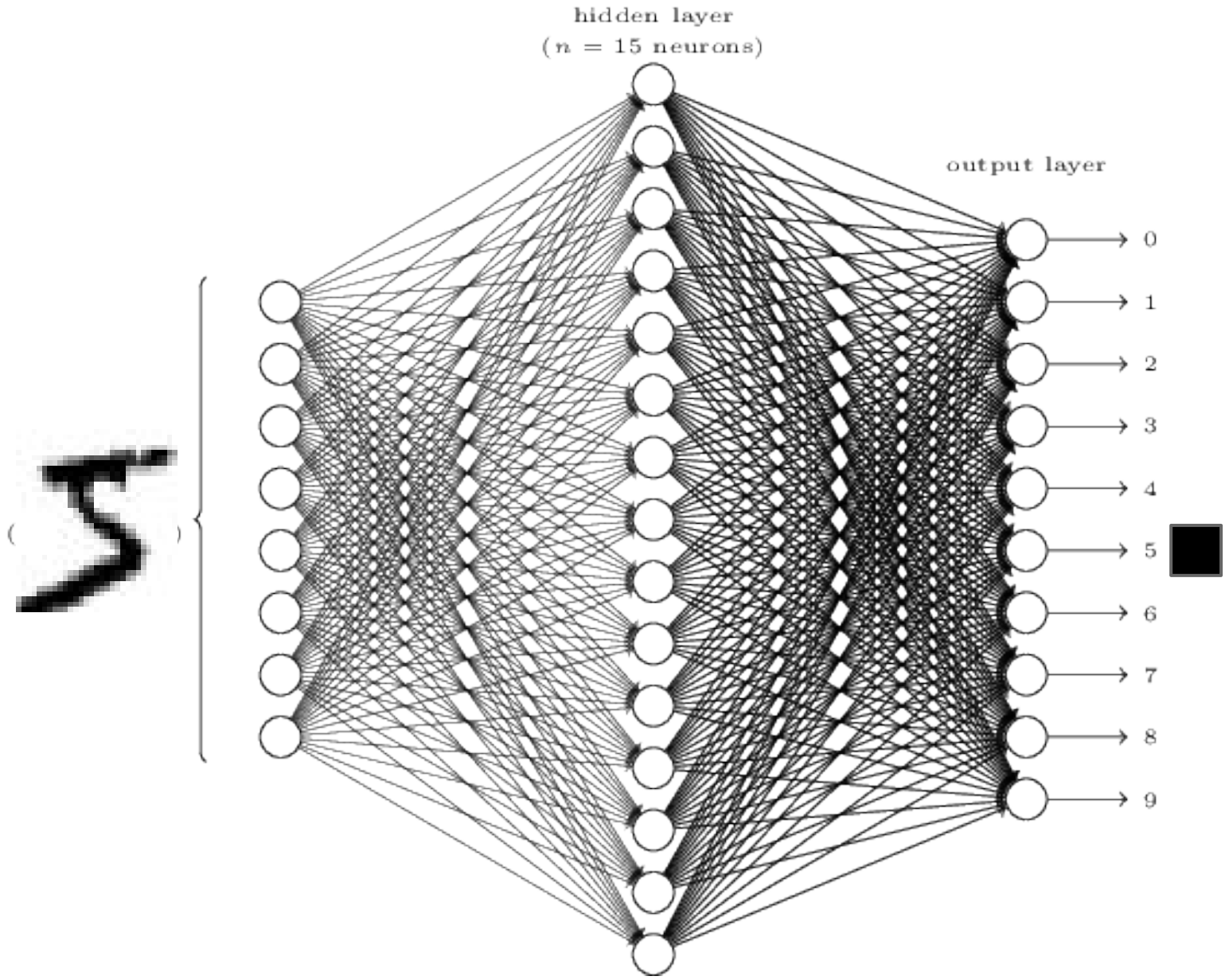

Different
weights
Activation
level


x_1
x_2
x_3
output

Pixels



Classification


hidden layer
(n = 15 neurons)
output layer
0
1
2
3
4
5
6
7
8
9