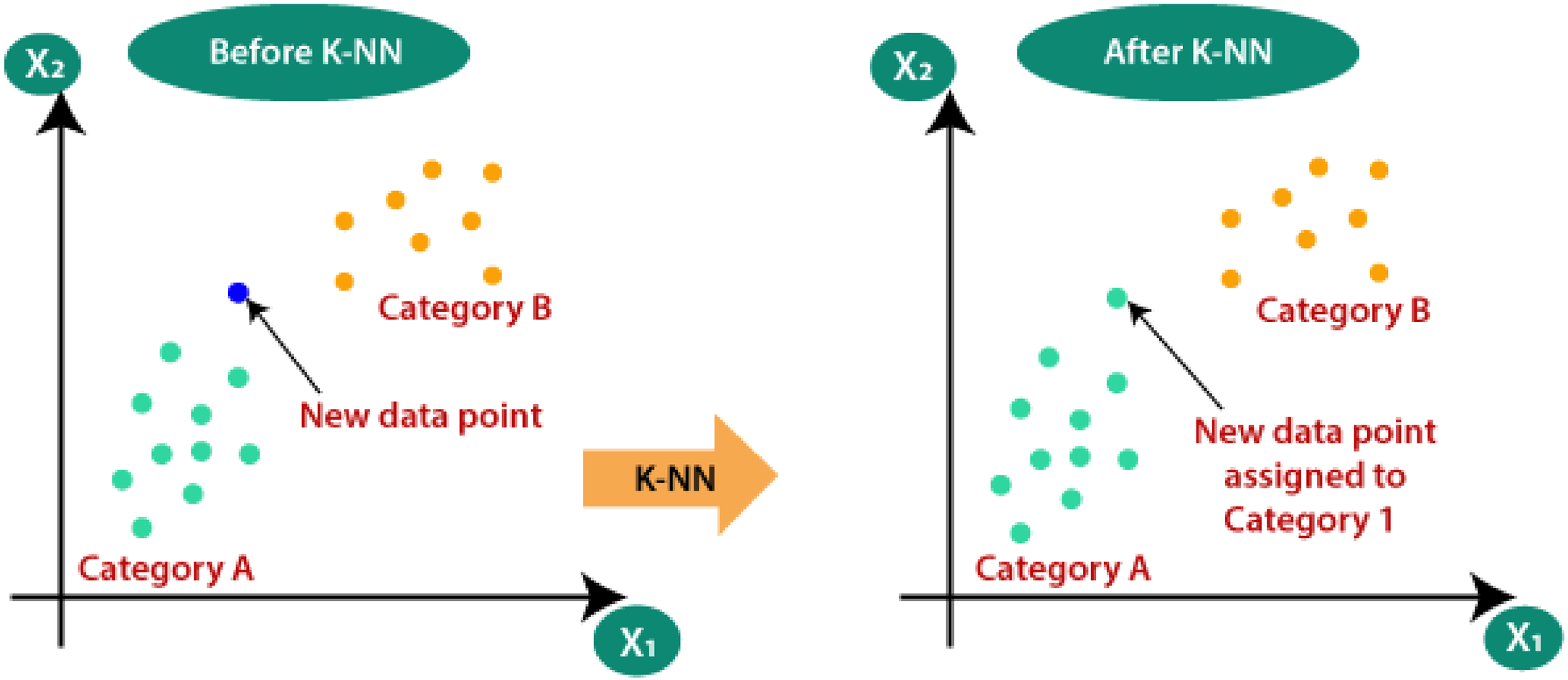
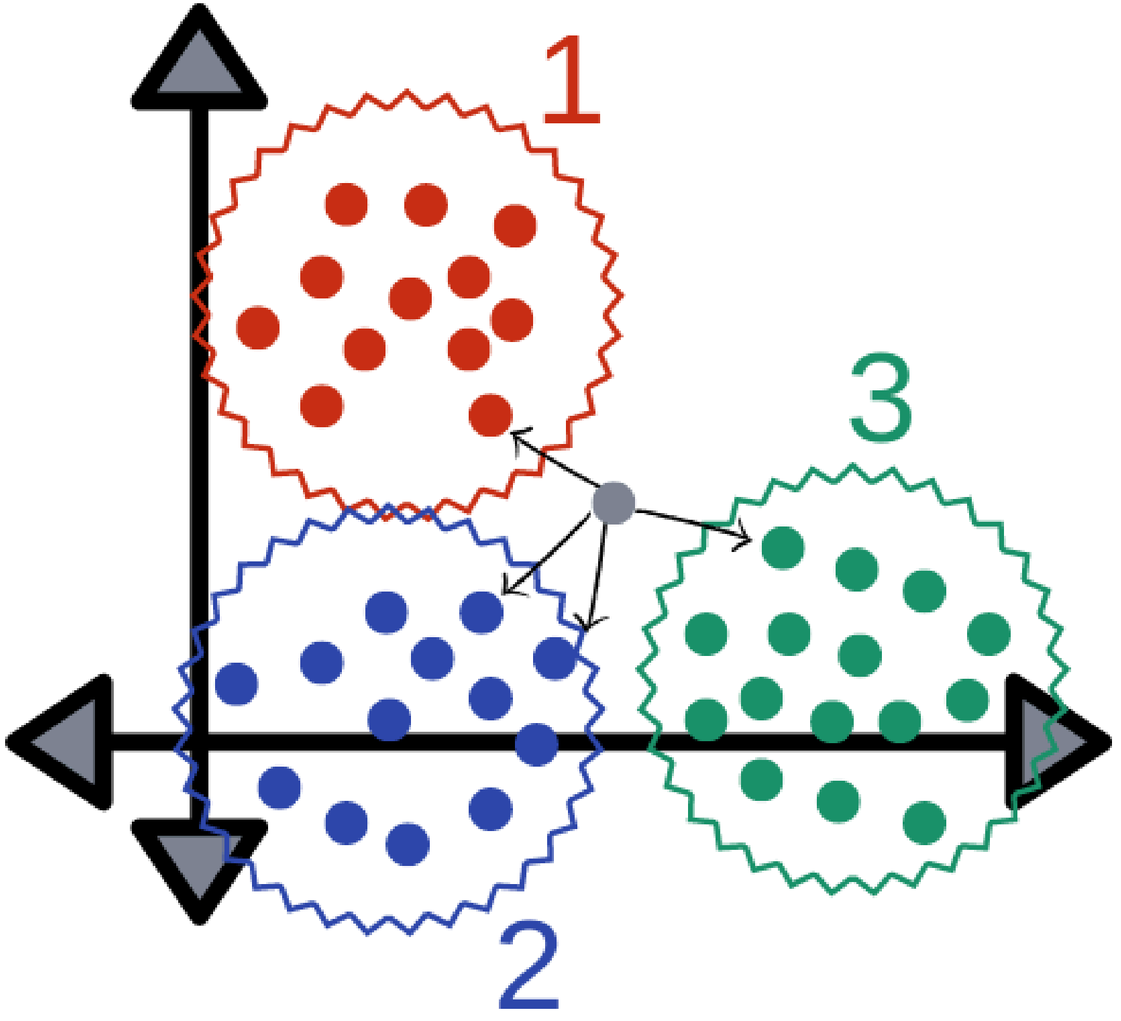
KNN


Before K-NN
X2
Category B
New data point
Category A
X1
K-NN
After K-NN
X2
Category B
New data point
assigned to
Category 1
Category A
X1


1
3
2

KNN is one of the easiest machine-learning algorithms to understand.
Think of it like this:
👉 “Tell me who your closest friends are, and I’ll guess who you are.”
It predicts something about a new data point by looking at the most similar existing points.

When a new example comes:

1. Measure distance between the new example and all training data.
2. Pick the **K closest** ones.
3. Use them to decide the answer.

- For **classification** → majority vote
- For **regression** → average value

Imagine you move to a new school.

You want to guess if a student likes football.

You look at his **5 closest friends**.

If 4 like football → probably he does too.

That's KNN.

🎯 Problem

We want to classify whether a person is **Fit** or **Unfit**.

Features:

- X1 = Exercise hours per week
- X2 = Junk food meals per week

Training Data

Person	X1 (Exercise)	X2 (Junk)	Result
P1	1	8	Unfit
P2	2	7	Unfit
P3	6	2	Fit
P4	7	3	Fit

🆕 New Person

X1 = 3

X2 = 6

We must predict → Fit or Unfit.

⚙️ Step 1 — Choose K

Let's take:

K = 3

📏 Step 2 — Calculate distance

We use **Euclidean distance**:

$$distance = \sqrt{(x1 - x2)^2 + (y1 - y2)^2}$$

(New point = 3,6)

Distance to P1 (1,8)

$$\sqrt{(3-1)^2+(6-8)^2} = \sqrt{4+4} = \sqrt{8} = 2.83$$

Distance to P2 (2,7)

$$\sqrt{(3-2)^2+(6-7)^2} = \sqrt{1+1} = \sqrt{2} = 1.41$$

Distance to P3 (6,2)

$$\sqrt{(3-6)^2+(6-2)^2} = \sqrt{9+16} = \sqrt{25} = 5$$

Distance to P4 (7,3)

$$\sqrt{(3-7)^2+(6-3)^2} = \sqrt{16+9} = \sqrt{25} = 5$$

📊 Step 3 — Put in table

Person	Result	Distance
P1	Unfit	2.83
P2	Unfit	1.41
P3	Fit	5
P4	Fit	5

📌 Step 4 — Select nearest K=3

Smallest distances:

- P2 → Unfit
- P1 → Unfit
- P3 → Fit *(P3 & P4 tie; pick one)*

Step 5 — Majority vote

Unfit = 2

Fit = 1