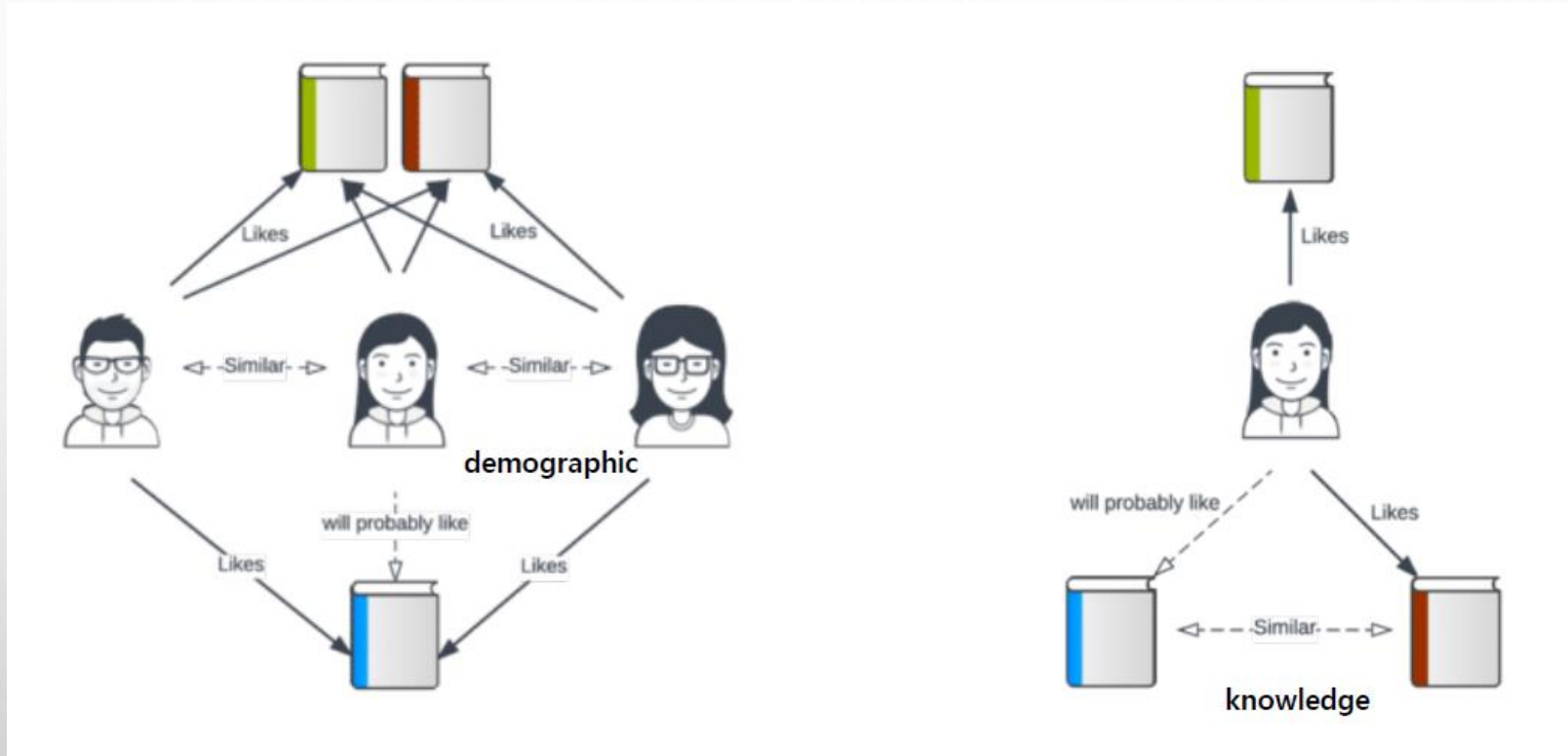


The background is a light gray gradient. It is decorated with numerous realistic water droplets of various sizes, some clustered in the top left and bottom right corners. A faint, circular logo is centered in the upper half of the image, featuring a globe and the text "UNITED NATIONS" and "SUSTAINABLE DEVELOPMENT GOALS".

# RECOMMENDATION














# 추천 시스템



사용자가 선호할 만한 아이템을 추측하여 여러 항목 중 사용자에게 적합한 항목을 제공하는 시스템  
아마존, 넷플릭스, 유튜브 등 많은 업체에서 추천 서비스를 제공하고 있다.







# 추천 시스템

## USER & ITEM

	 TV	 Camera	 iPod	 iPhone	 iPad	 Macbook	 Headphone
1 							
2 							
3 							
4 							
5 							
6 							














# 추천 시스템

## ORDER DATA

	 TV	 Camera	 iPod	 iPhone	 iPad	 Macbook	 Headphone
1	BUY!	BUY!		BUY!		BUY!	
2	BUY!		BUY!		BUY!		BUY!
3	BUY!			BUY!			BUY!
4		BUY!		BUY!		BUY!	
5		BUY!	BUY!		BUY!		
6	BUY!	BUY!			BUY!		














# 추천 시스템

## ORDER DATA (cont.)

	 TV	 Camera	 iPod	 iPhone	 iPad	 Macbook	 Headphone
 1	1	1		1		1	
 2	1		1		1		1
 3	1			1			1
 4		1		1		1	
 5		1	1		1		
 6	1	1			1		




# 추천 시스템

## ORDER DATA (cont.)

	 TV	 Camera	 iPod	 iPhone	 iPad	 Macbook	 Headphone
 1	1	1	0	1	0	1	0
 2	1	0	1	0	1	0	1
 3	1	0	0	1	0	0	1
 4	0	1	0	1	0	1	0
 5	0	1	1	0	1	0	0
 6	1	1	0	0	1	0	0

# 추천 시스템

## VECTORS

	 TV	 Camera	 iPod	 iPhone	 iPad	 Macbook	 Headphone
 1	1	1	0	1	0	1	0
 2	1	0	1	0	1	0	1
 3	1	0	0	1	0	0	1
 4	0	1	0	1	0	1	0
 5	0	1	1	0	1	0	0
 6	1	1	0	0	1	0	0

# 추천 시스템

## VECTORS

---

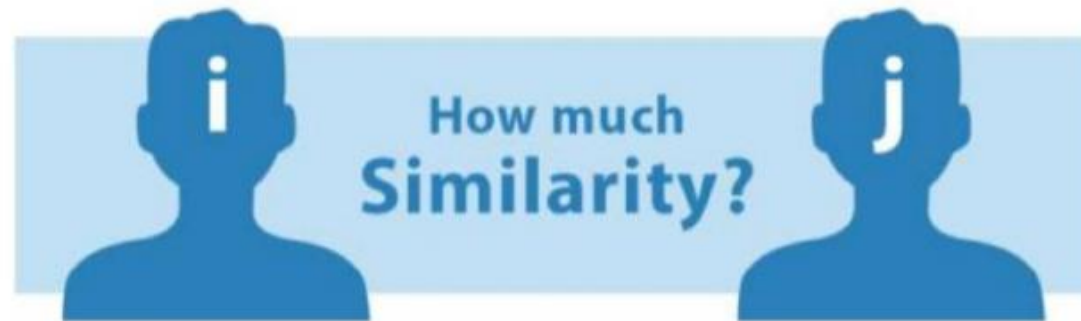
$$\begin{aligned} \text{User 1} &= (1, 1, 0, 1, 0, 1, 0) \\ \text{User 2} &= (1, 0, 1, 0, 1, 0, 1) \\ \text{User 3} &= (1, 0, 0, 1, 0, 0, 1) \\ \text{User 4} &= (0, 1, 0, 1, 0, 1, 0) \\ \text{User 5} &= (0, 1, 1, 0, 1, 0, 0) \\ \text{User 6} &= (1, 1, 0, 0, 1, 0, 0) \end{aligned}$$



# 추천 시스템

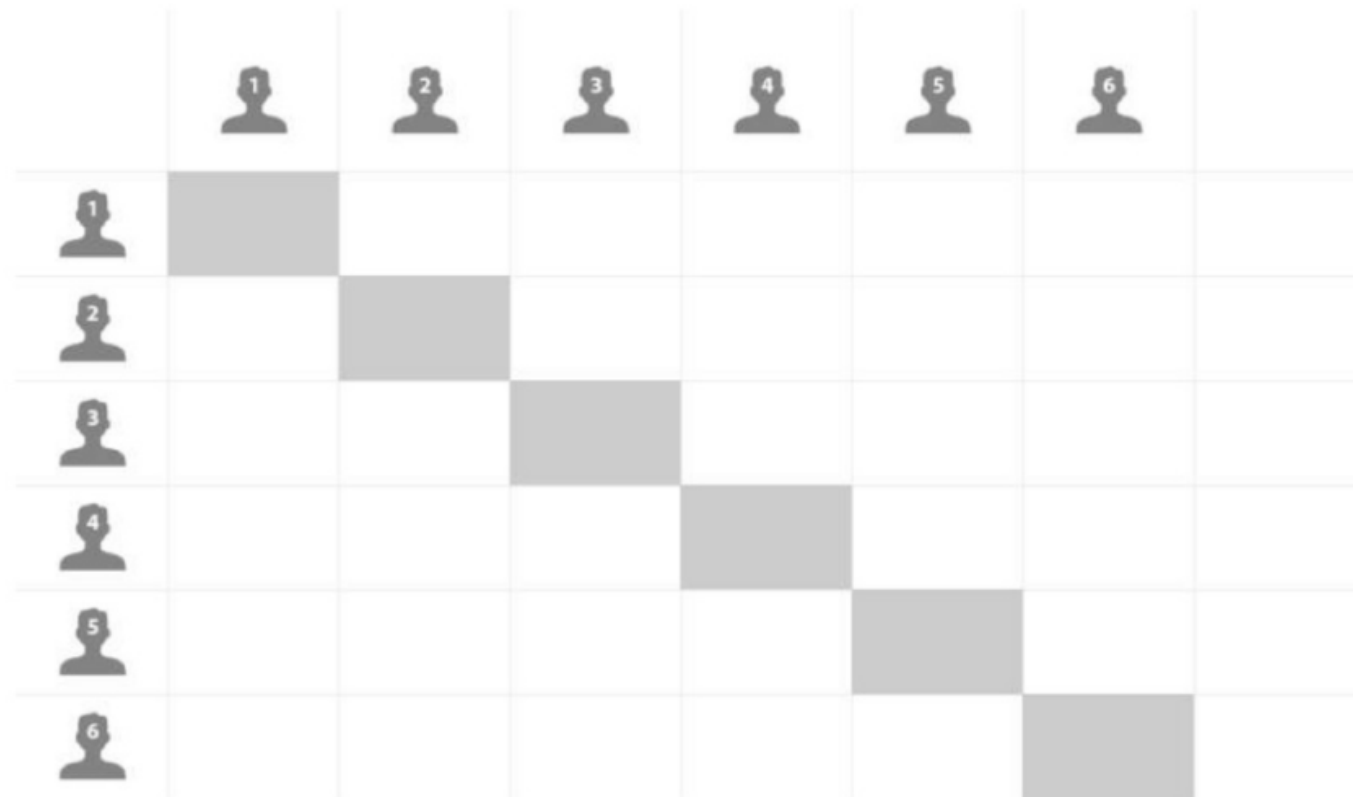
## SIMILARITY CALCULATION

---















# 추천 시스템

## USER SIMILARITY MATRIX



A 6x6 grid representing a user similarity matrix. The columns are labeled with user icons and numbers 1 through 6 at the top. The rows are labeled with user icons and numbers 1 through 6 on the left. The diagonal cells, from top-left to bottom-right, are shaded gray, indicating a similarity of 1.0 for self-comparisons. All other cells are white, representing unknown similarity values.

	 1	 2	 3	 4	 5	 6
 1						
 2						
 3						
 4						
 5						
 6						

# 추천 시스템

## SIMILARITY CALCULATION

---

### Cosine similarity

$$\text{similarity} = \cos(\theta) = \frac{A \cdot B}{\|A\| \|B\|} = \frac{\sum_{i=1}^n A_i B_i}{\sqrt{\sum_{i=1}^n A_i^2} \sqrt{\sum_{i=1}^n B_i^2}}$$

# 추천 시스템

## SIMILARITY CALCULATION













	<b>1</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>
	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>

$$\begin{aligned}\text{Sim}(u1, u2) &= \frac{1 \times 1 + 1 \times 0 + 0 \times 1 + 1 \times 0 + 0 \times 1 + 1 \times 0 + 0 \times 1}{\sqrt{1^2 + 1^2 + 0^2 + 1^2 + 0^2 + 1^2 + 0^2} \times \sqrt{1^2 + 0^2 + 1^2 + 0^2 + 1^2 + 0^2 + 1^2}} \\ &= 0.25\end{aligned}$$

$$\text{similarity} = \cos(\theta) = \frac{A \cdot B}{\|A\| \|B\|} = \frac{\sum_{i=1}^n A_i B_i}{\sqrt{\sum_{i=1}^n A_i^2} \sqrt{\sum_{i=1}^n B_i^2}}$$













# 추천 시스템

## SIMILARITY CALCULATION EXAMPLE

						
		0.25	0.577	0.866	0.289	0.577
	0.25		0.577	0	0.577	0.577
	0.577	0.577		0.333	0	0.333
	0.866	0	0.333		0.333	0.333
	0.289	0.577	0	0.333		0.667
	0.577	0.577	0.333	0.333	0.667	

# 추천 시스템

## K-NEAREST-NEIGHBOR

						
		<b>0.25</b>	<b>0.577</b>	<b>0.866</b>	<b>0.289</b>	<b>0.577</b>
	0.25		0.577	0	0.577	0.577
	0.577	0.577		0.333	0	0.333
	0.866	0	0.333		0.333	0.333
	0.289	0.577	0	0.333		0.667
	0.577	0.577	0.333	0.333	0.667	

# 추천 시스템

## K-NEAREST-NEIGHBOR

---

**K = 4**

~ Only get 4 most similar users (nearest neighbor)



0.866



0.577



0.577



0.289



0.25



# 추천 시스템

## NEIGHBORS' ORDER

**K = 4**

~ Only get 4 most similar users (nearest neighbor)



0.866



0.577



0.577



0.289



0.25





# 추천 시스템

## REMOVE BOUGHT ITEMS



0.866



0.577



0.577



0.289



0.25



0.289



0.577



0.577



0.289

**K = 4**

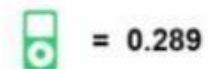
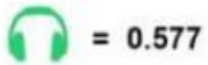
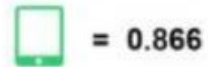
~ Only get 4 most similar users (nearest neighbor)

# 추천 시스템

## CALCULATING FINAL SCORE

**K = 4**

~ Only get 4 most similar users (nearest neighbor)



0.866



0.577



0.577



0.289



0.25



0.577

0.577

0.289

The background is a light gray gradient with several realistic water droplets of various sizes scattered across it. Some droplets are in the top left, some in the bottom right, and others are smaller and more numerous in the center and bottom. The droplets have highlights and shadows, giving them a three-dimensional appearance.

**LET'S DO IT!**