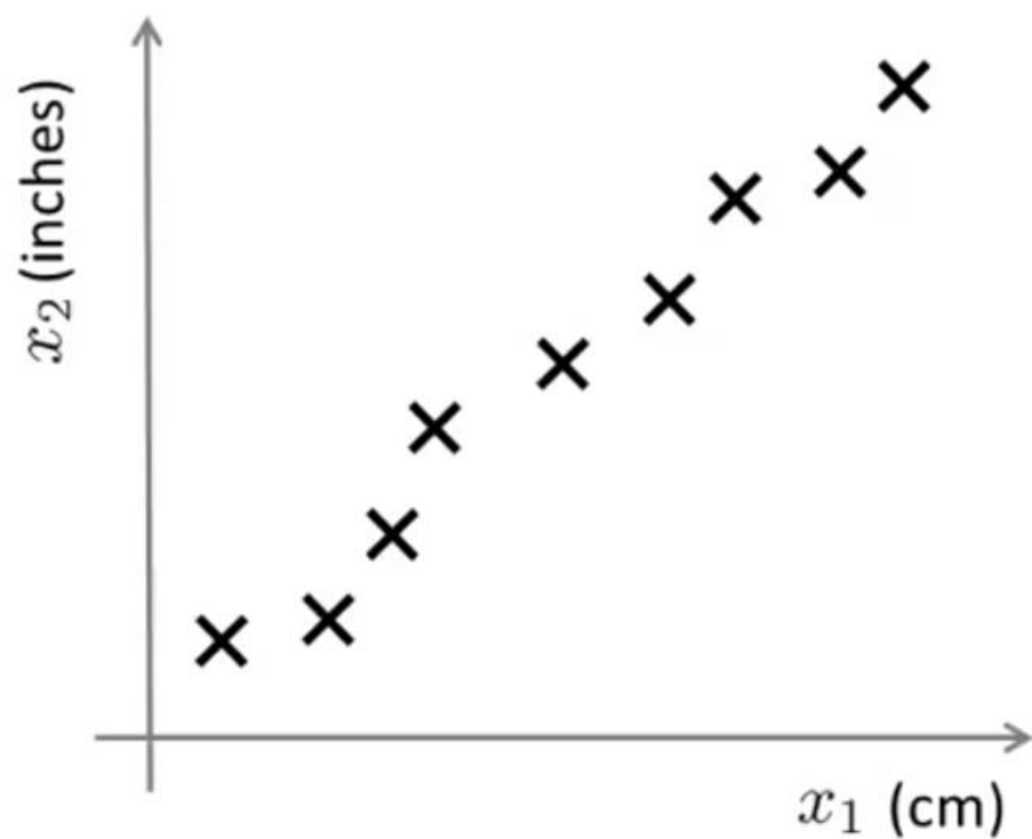


# Motivation 1: Data Compression

*Dimensionality Reduction*

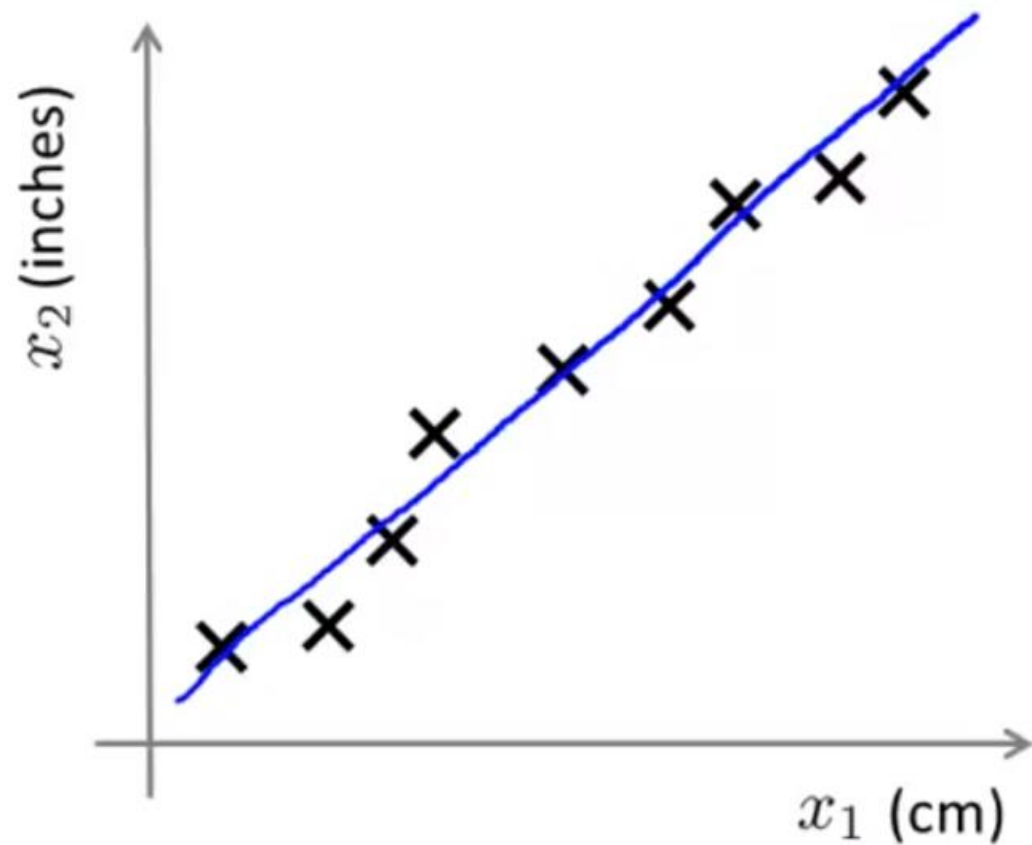
Unsupervised Learning

# Data Compression



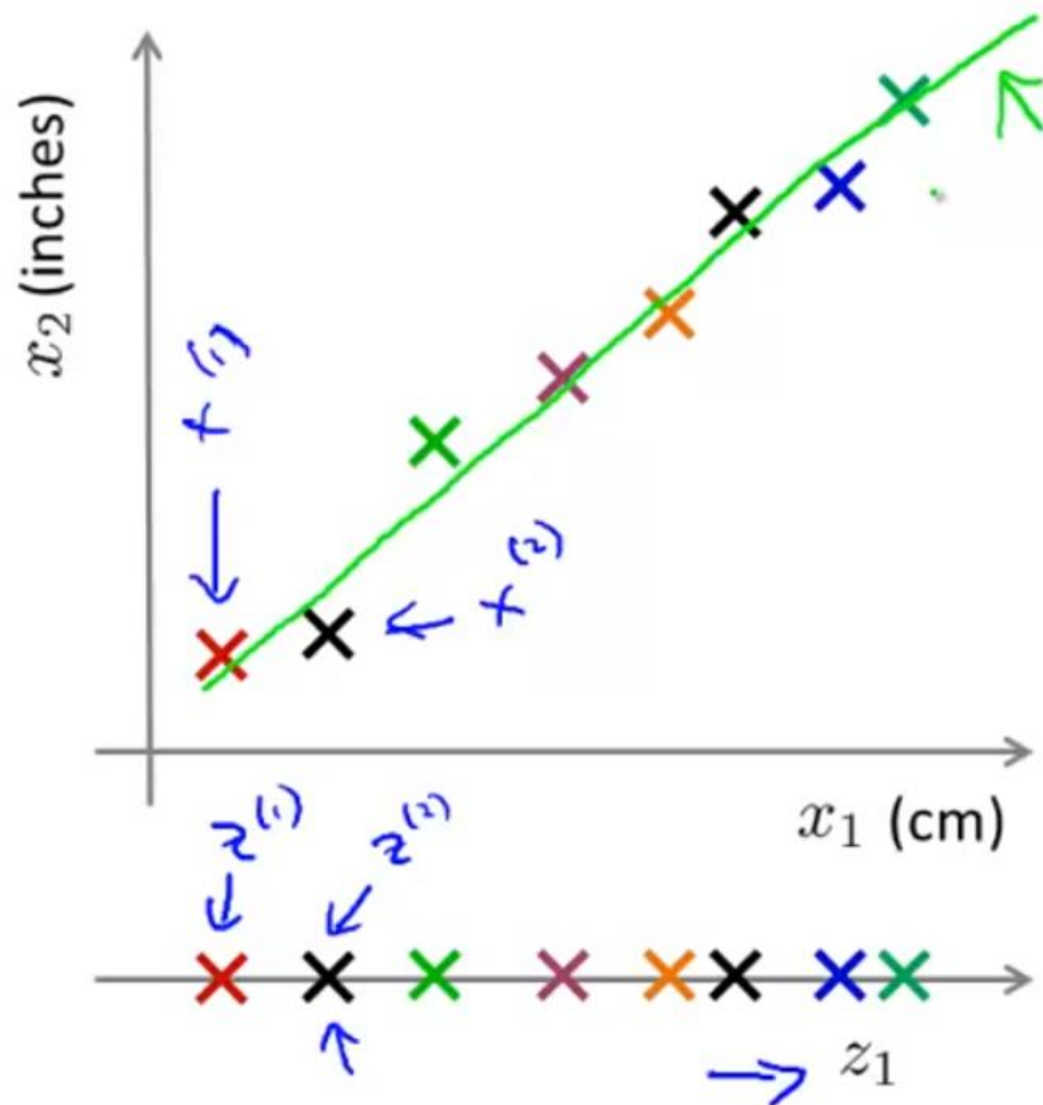
Reduce data from  
2D to 1D

# Data Compression



Reduce data from  
2D to 1D

# Data Compression



Reduce data from  
2D to 1D

$$x^{(1)} \in \mathbb{R}^2 \rightarrow z^{(1)} \in \mathbb{R}$$

$$x^{(2)} \in \mathbb{R}^2 \rightarrow z^{(2)} \in \mathbb{R}$$

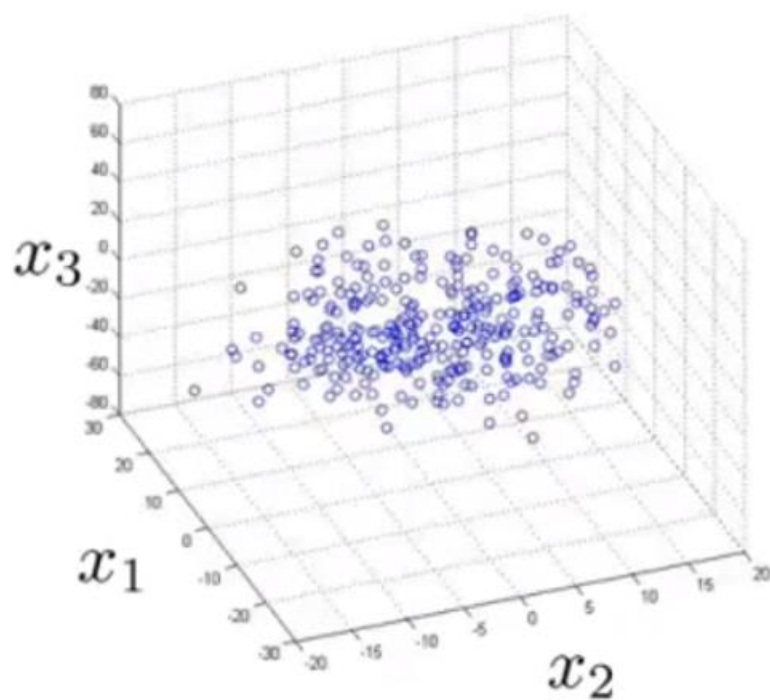
⋮

$$x^{(m)} \rightarrow z^{(m)}$$

# Data Compression

10000  $\rightarrow$  1000

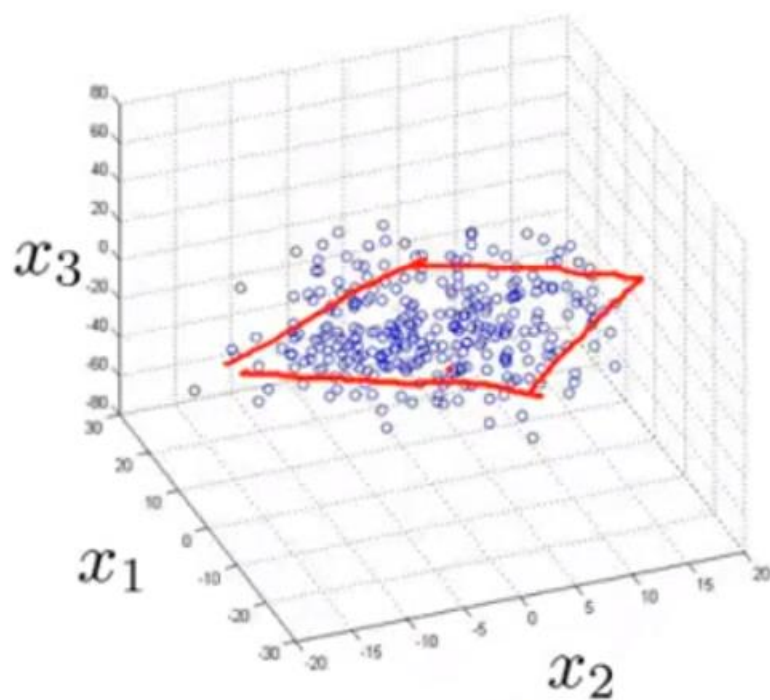
Reduce data from 3D to 2D



# Data Compression

10000  $\rightarrow$  1000

Reduce data from 3D to 2D

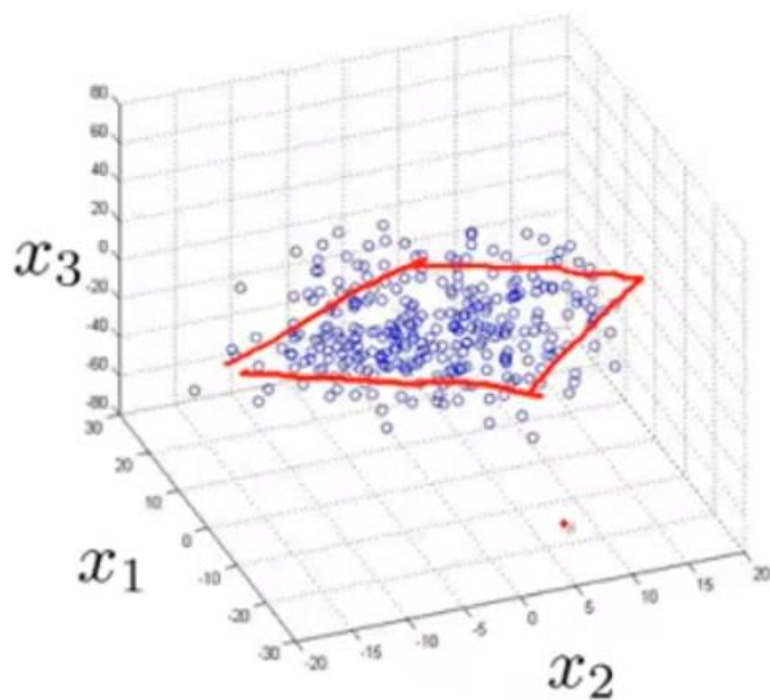


$$x^{(i)} \in \mathbb{R}^3$$

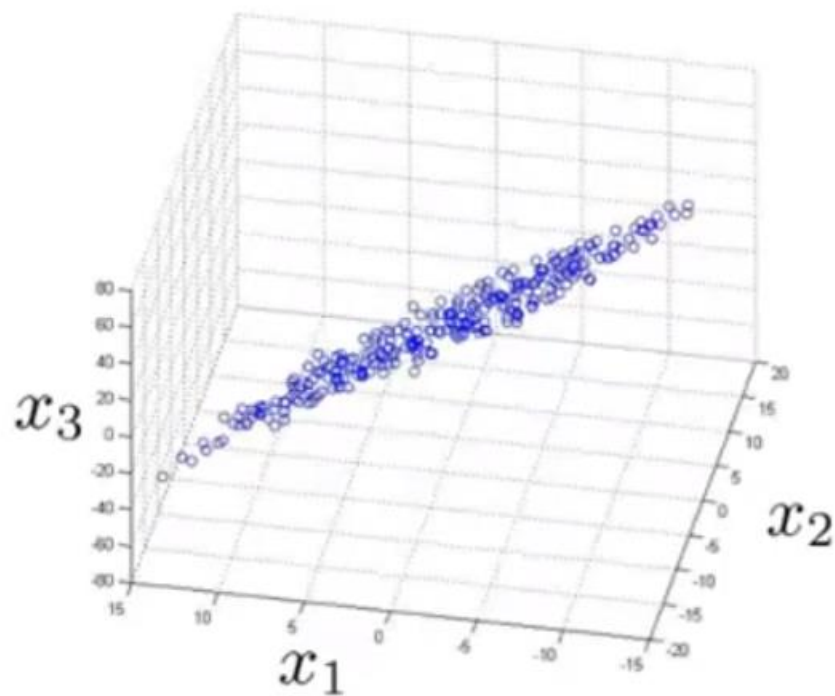
# Data Compression

10000  $\rightarrow$  1000

Reduce data from 3D to 2D



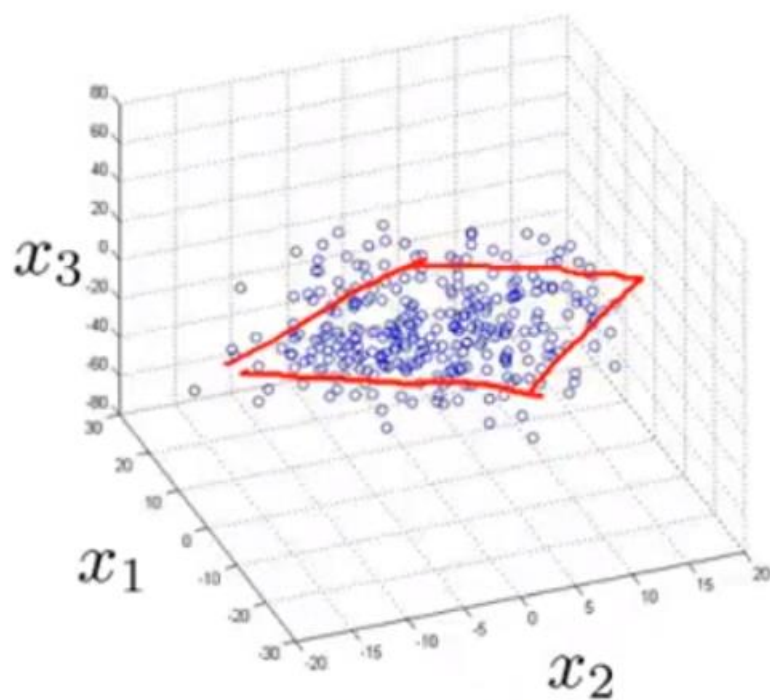
$$x^{(i)} \in \mathbb{R}^3$$



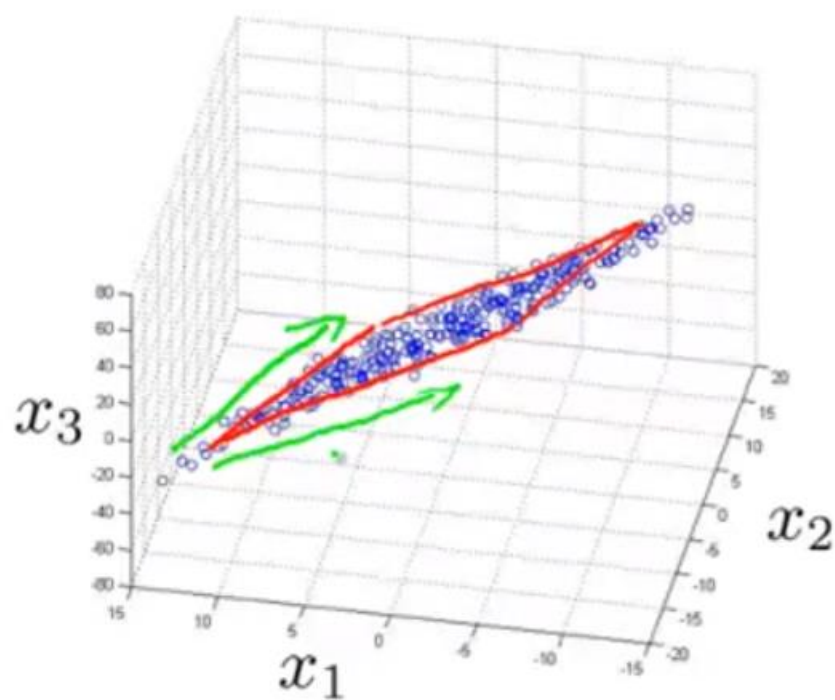
# Data Compression

10000  $\rightarrow$  1000

Reduce data from 3D to 2D



$$x^{(i)} \in \mathbb{R}^3$$

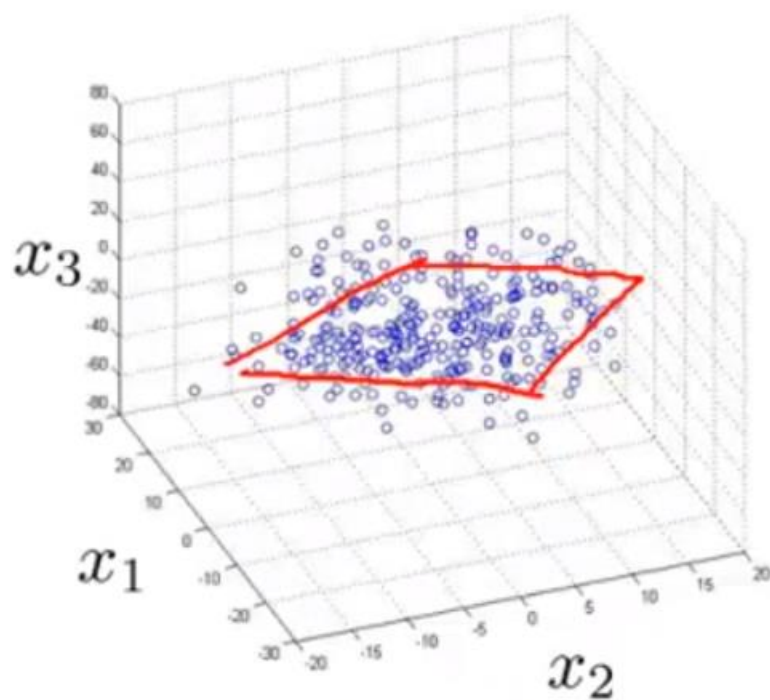




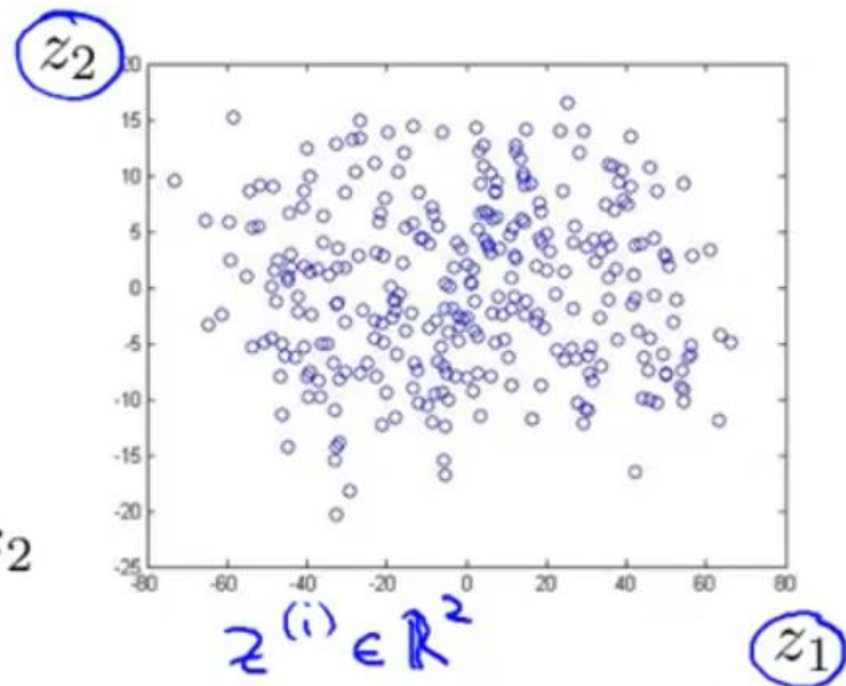
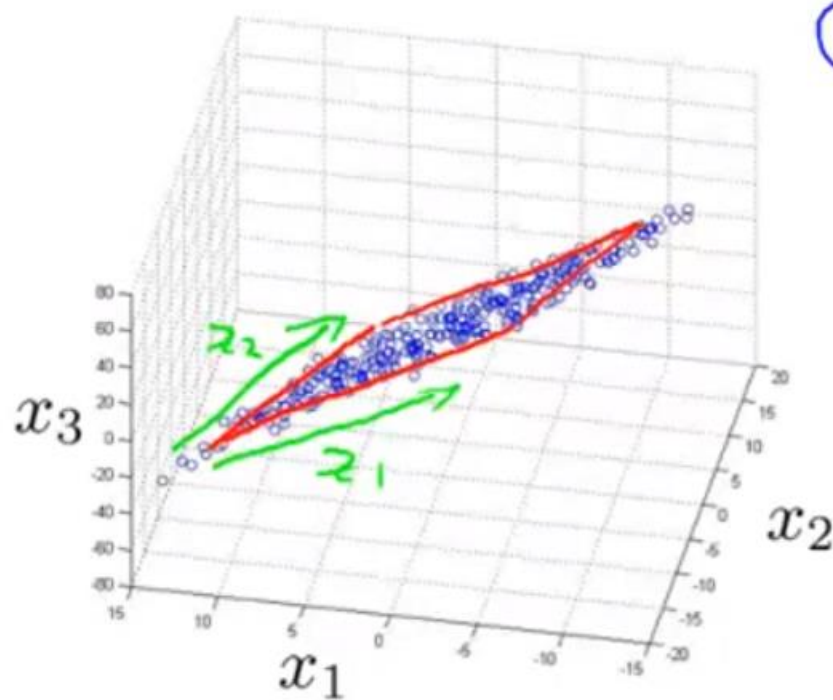
# Data Compression

10000  $\rightarrow$  1000

Reduce data from 3D to 2D



$$x^{(i)} \in \mathbb{R}^3$$



$$z^{(i)} \in \mathbb{R}^2$$

$$z = \begin{bmatrix} z_1 \\ z_2 \end{bmatrix} \quad z^{(i)} = \begin{bmatrix} z_1^{(i)} \\ z_2^{(i)} \end{bmatrix}$$

# Motivation 2: Data Visualization

*Dimensionality Reduction*

Unsupervised Learning

# Data Visualization

$$x \in \mathbb{R}^{50}$$

Country	$x_1$ GDP (trillions of US\$)	$x_2$ Per capita GDP (thousands of intl. \$)	$x_3$ Human Development Index	$x_4$ Life expectancy	$x_5$ Poverty Index (Gini as percentage)	$x_6$ Mean household income (thousands of US\$)	...
Canada	1.577	39.17	0.908	80.7	32.6	67.293	...
China	5.878	7.54	0.687	73	46.9	10.22	...
India	1.632	3.41	0.547	64.7	36.8	0.735	...
Russia	1.48	19.84	0.755	65.5	39.9	0.72	...
Singapore	0.223	56.69	0.866	80	42.5	67.1	...
USA	14.527	46.86	0.91	78.3	40.8	84.3	...
...	...	...	...	...	...	...	...

Windows'u Etkinleştir  
Windows'u etkinleştirmek için Ayarlar'a gidin.

# Data Visualization

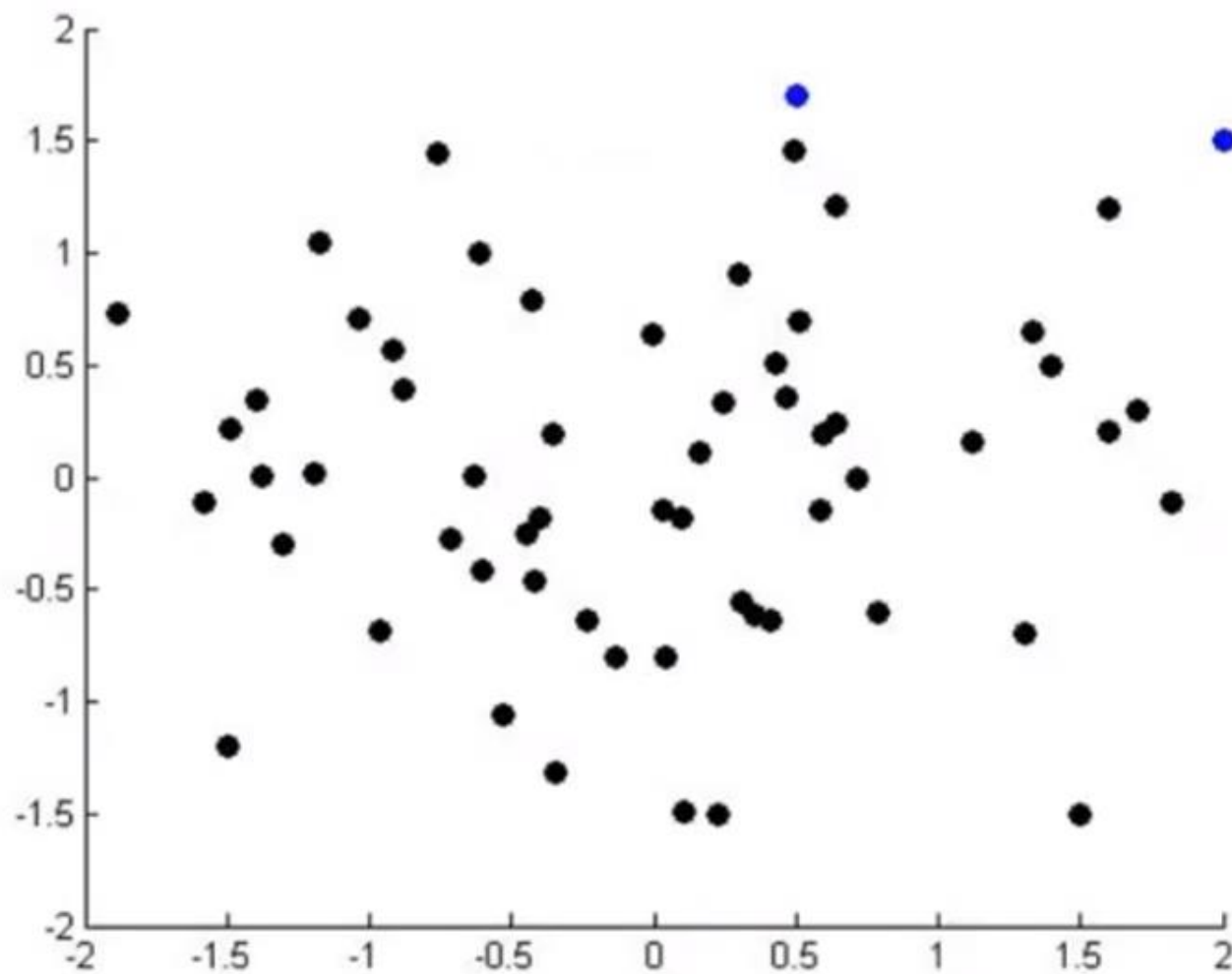
Country	$z_1$	$z_2$
Canada	1.6	1.2
China	1.7	0.3
India	1.6	0.2
Russia	1.4	0.5
Singapore	0.5	1.7
USA	2	1.5
...	...	...

$$z^{(i)} \in \mathbb{R}^2$$

Reduce data  
from 500  
to 2D

Windows'u Etkinleştir  
Windows'u etkinleştirmek için Ayarlar'a gidin.

# Data Visualization



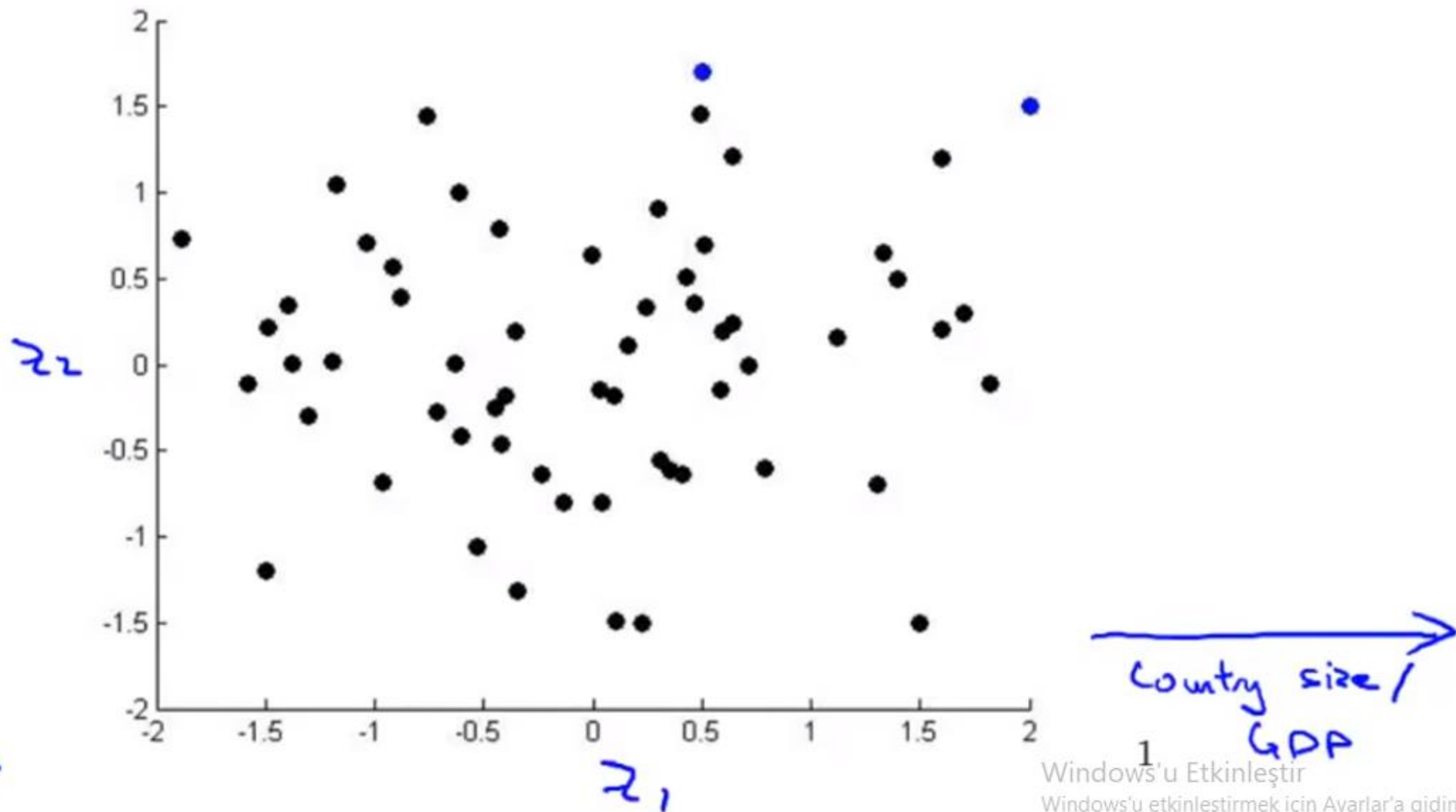
$$z^{(i)} \in \mathbb{R}$$

1  
Windows'u Etkinleştir  
Windows'u etkinleştirmek için Ayarlar'a gidin.

# Data Visualization

per-person  
GDP  
(economic  
activity)

$z^{(i)} \in \mathbb{R}$



Windows'u Etkinleştir  
Windows'u etkinleştirmek için Ayarlar'a gidin.