



# **CIS 635 Knowledge Discovery & Data Mining**

Feature scaling



# Feature Scaling

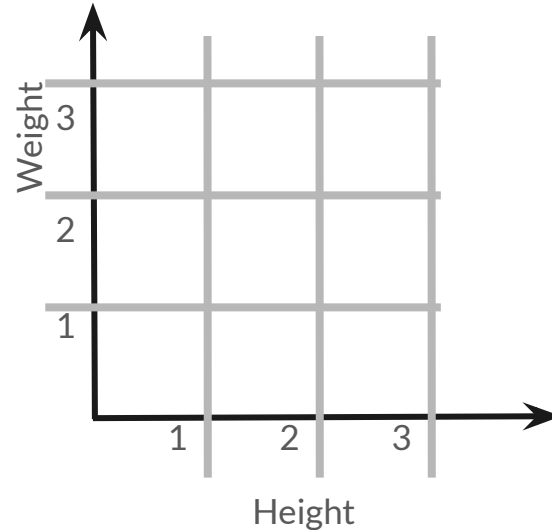
Lets we are given a set of data points

|   | height(meter) | weight(kg) |
|---|---------------|------------|
| 0 | 1.50          | 70         |
| 1 | 1.70          | 80         |
| 2 | 1.80          | 82         |
| 3 | 1.60          | 75         |
| 4 | 1.75          | 78         |

# Feature Scaling

Lets we are given a set of data points; we want to plot them on a 2D cartesian plane (vector space)

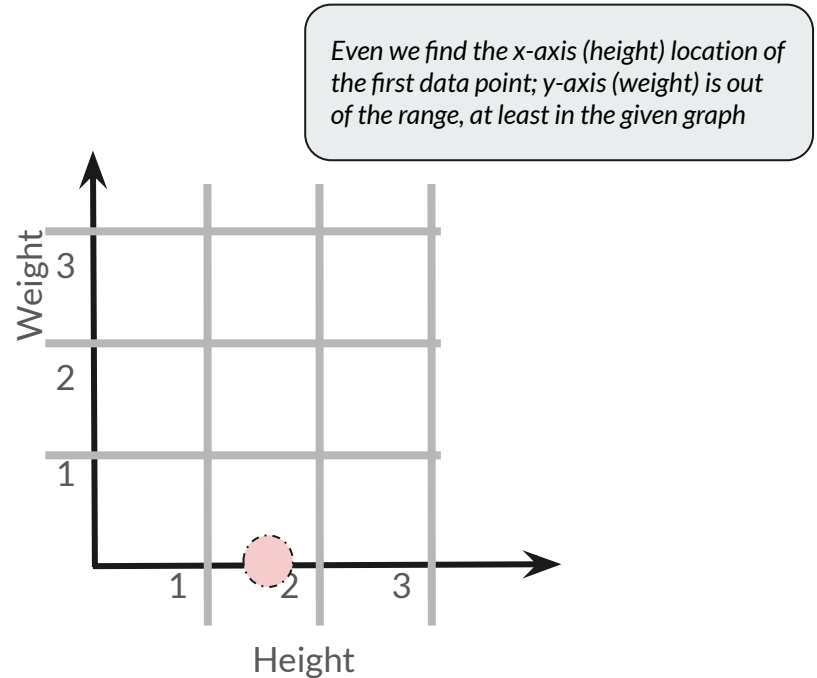
|   | height(meter) | weight(kg) |
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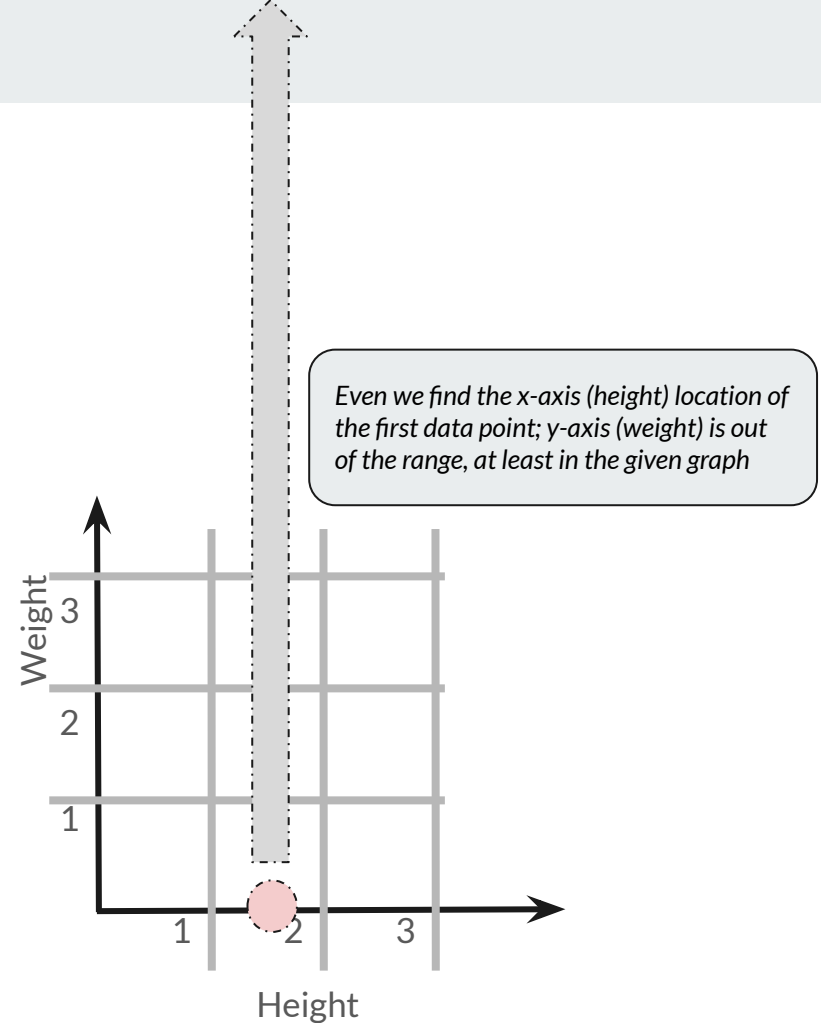
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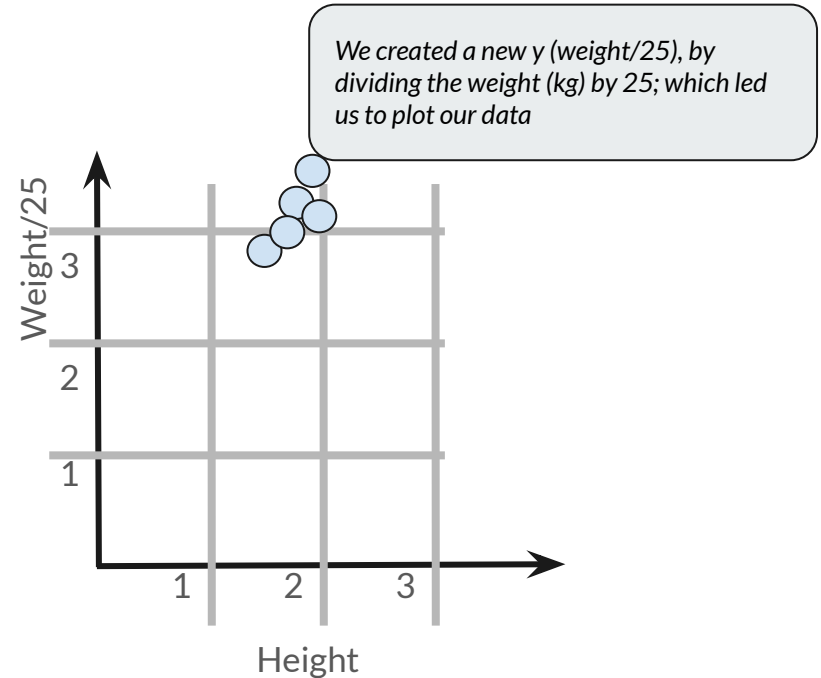
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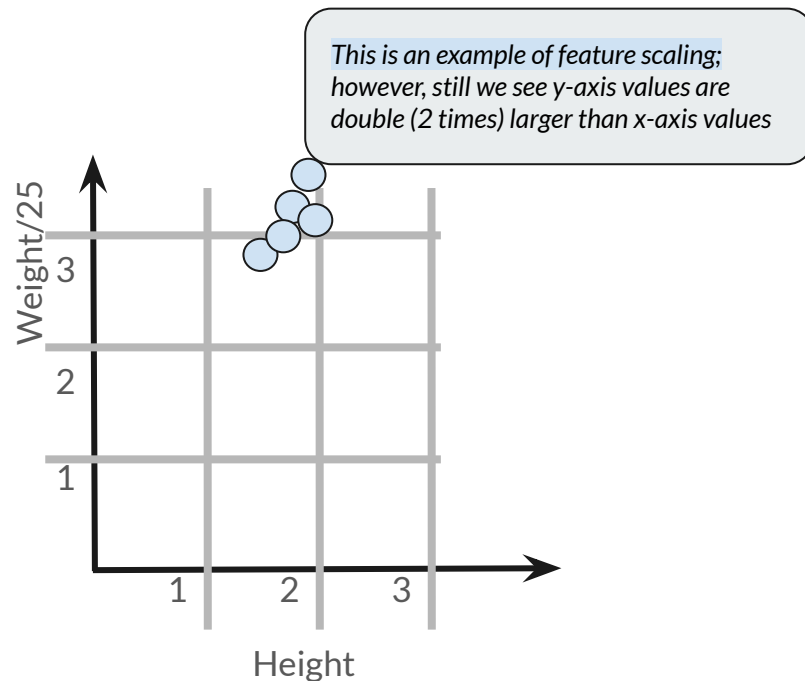
|   | height(meter) | weight(kg) | weight(kg)/25 |
|---|---------------|------------|---------------|
| 0 | 1.50          | 70         | 2.80          |
| 1 | 1.70          | 80         | 3.20          |
| 2 | 1.80          | 82         | 3.28          |
| 3 | 1.60          | 75         | 3.00          |
| 4 | 1.75          | 78         | 3.12          |



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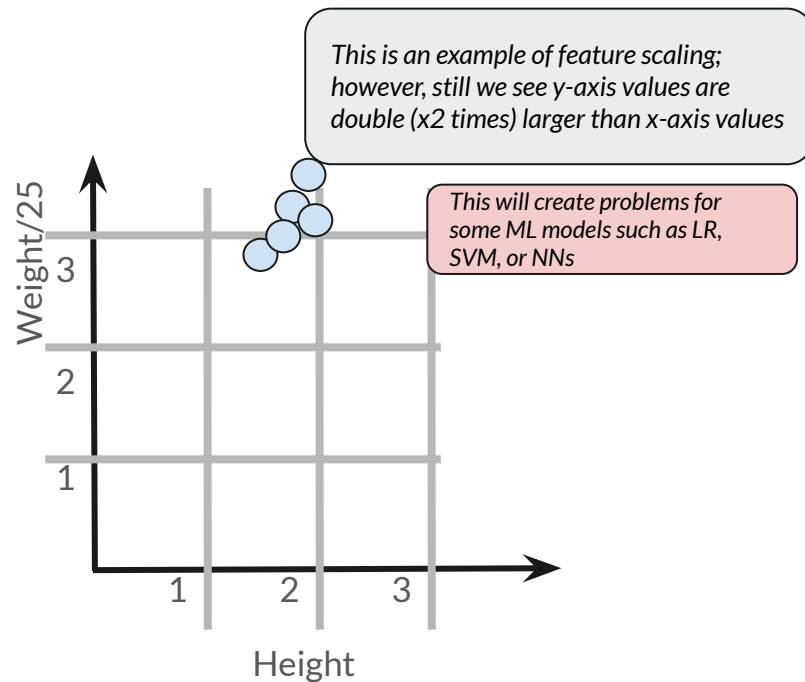
|   | height(meter) | weight(kg) | weight(kg)/25 |
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| 0 | 1.50          | 70         | 2.80          |
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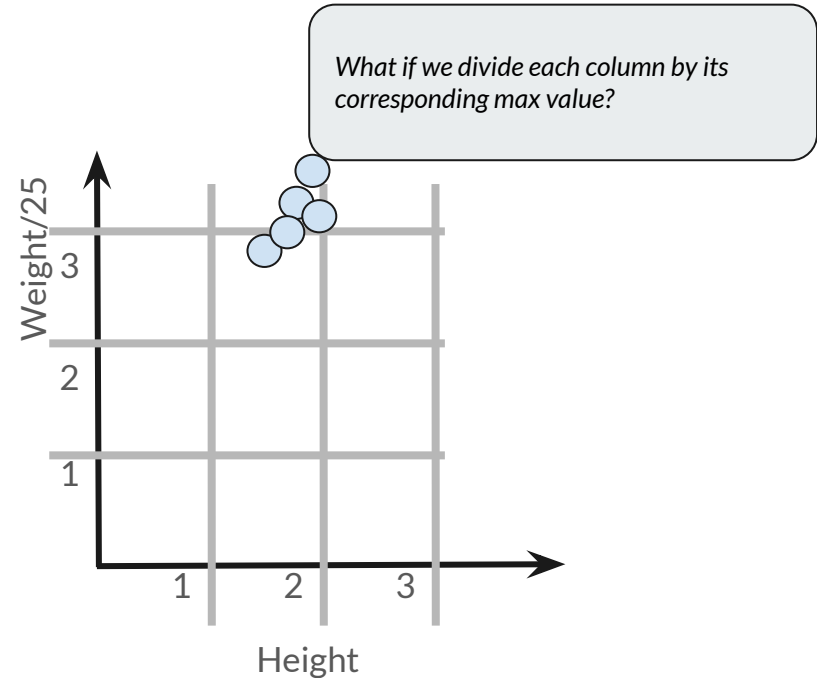




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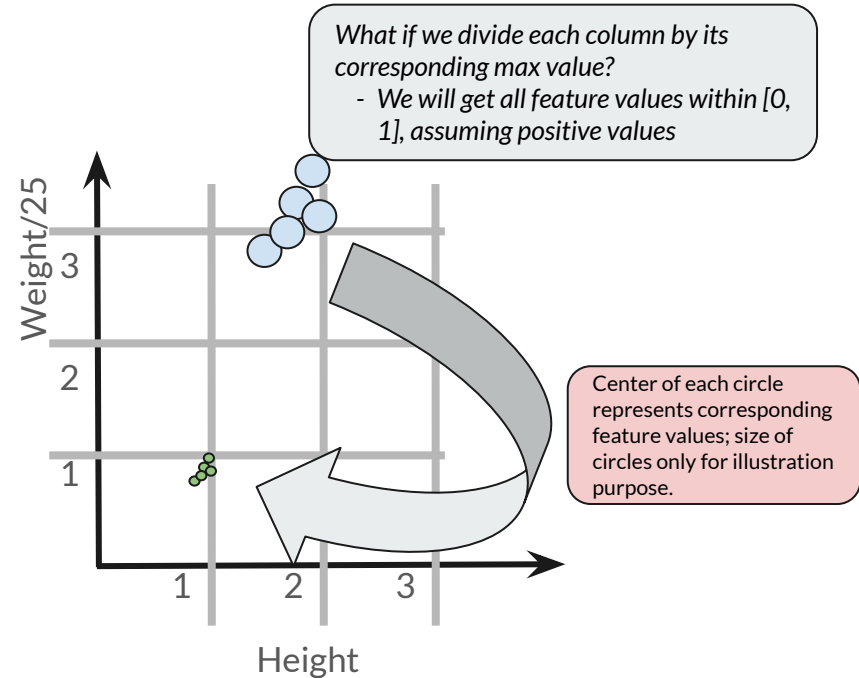
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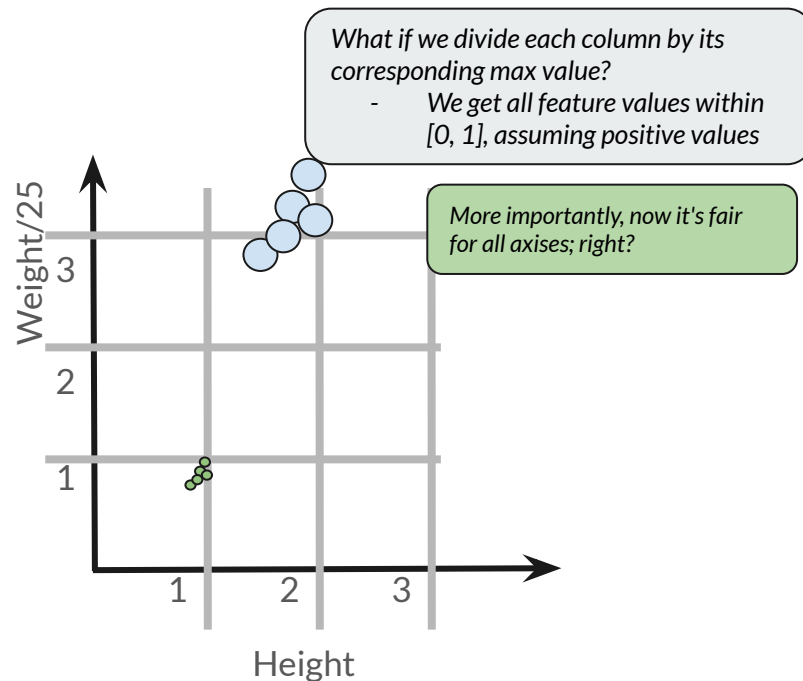
|   | height(meter) | weight(kg) | weight(kg)/25 | height/max(height) | weight/max(weight) |
|---|---------------|------------|---------------|--------------------|--------------------|
| 0 | 1.50          | 70         | 2.80          | 0.83               | 0.85               |
| 1 | 1.70          | 80         | 3.20          | 0.94               | 0.98               |
| 2 | 1.80          | 82         | 3.28          | 1.00               | 1.00               |
| 3 | 1.60          | 75         | 3.00          | 0.89               | 0.91               |
| 4 | 1.75          | 78         | 3.12          | 0.97               | 0.95               |



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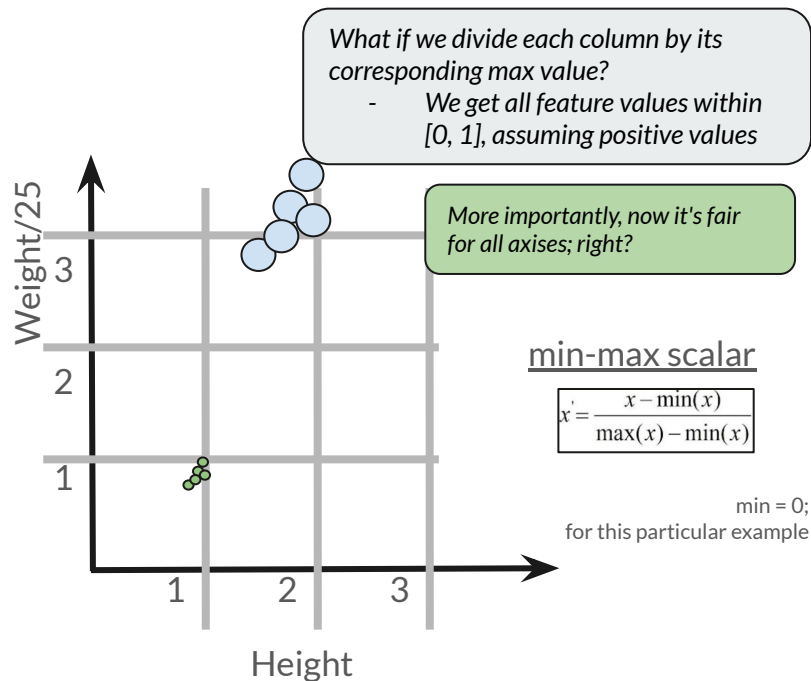
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# Feature Scaling

We have other scaling as well:

- Standard scalar

$$z = \frac{x - \mu}{\sigma}$$

$\mu$  = Mean

$\sigma$  = Standard Deviation



# Feature Scaling

We have other scaling as well:

- Standard scalar

|   | height(meter) | weight(kg) | height_ss | weight_ss |
|---|---------------|------------|-----------|-----------|
| 0 | 1.50          | 70         | 1.58      | 1.67      |
| 1 | 1.70          | 80         | -0.28     | -0.72     |
| 2 | 1.80          | 82         | -1.21     | -1.19     |
| 3 | 1.60          | 75         | 0.65      | 0.48      |
| 4 | 1.75          | 78         | -0.74     | -0.24     |

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- *Scaled features are centered across the Zero-axis*



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$$z = \frac{x - \mu}{\sigma}$$

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- Scaled features are centered across the Zero-axis
- NN community uses this extensively