Data Preprocessing

- Laxminarayen N V

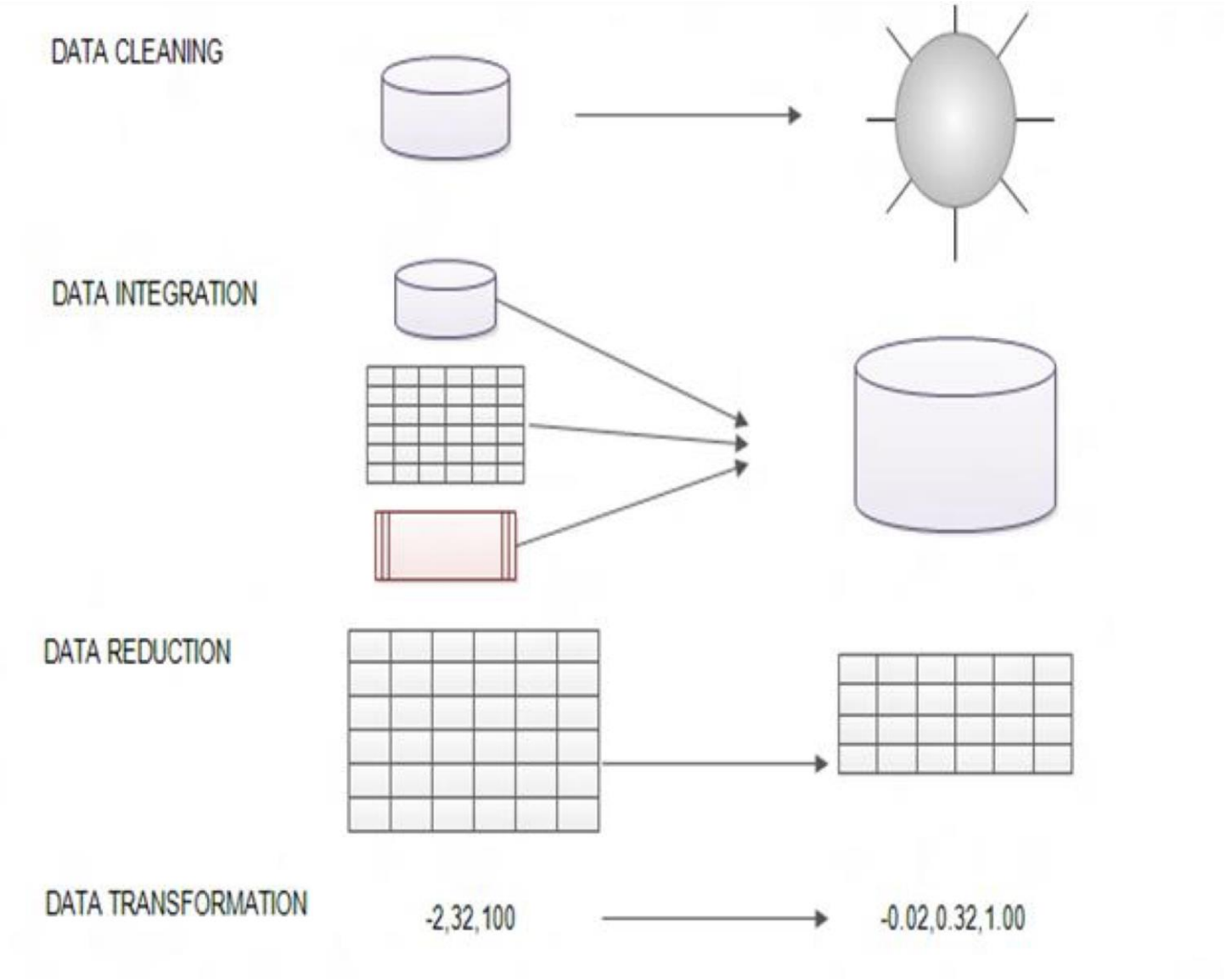
Real World Data

Any Problem?

S.No	Credit_rating	Age	Income	Credit_cards
1	0.00	21	10000	y
2	1.0		2500	n
3	2.0	62	-500	y
4	100.012	42		n
5	yes	200	1	y
6	30	0	Seventy thousand	No

Data Preprocessing

- Data Cleaning
- Data Integration
- Data Reduction
- Data Transformation



Data Cleaning

1. Missing Data
- Central Imputation
- KNN Imputation
- 2. Noisy Data
- Smoothing
- Clustering
1. Outlier Removal
- Using Boxplot

company name	furigana	postal code	address	telephone number
AlphaPurchase Co,. Ltd	Alpha Purchase	107-0061	Aoyama Building 12th floor, 1-2-3, Kita-Aoyama, Minato-ku, Tokyo	03-5772-7801
AAA Foundation	AAA	1500002	Kami-meguro, Meguro-ku X-X-X	0312345678
BBBB, Inc.	BBBB	123	Minami-Azabu, Minato-ku XX-1-1	03(1234)9876

company name	juridical personality	furigana	postal code	all prefectures	address	telephone number
Alpha Purchase	Co,. Ltd	Alpha Purchase	1070061	Tokyo	Aoyama Building 12th floor, 1-2-3, Kita-Aoyama, Minato-ku	0357727801
AAA	Foundation	AAA	1500002	Tokyo	Kami-meguro, Meguro-ku X-X-X	0312345678
BBBB	Inc.	BBBB	1230001	Tokyo	Minami-Azabu, Minato-ku XX-1-1	0312349876

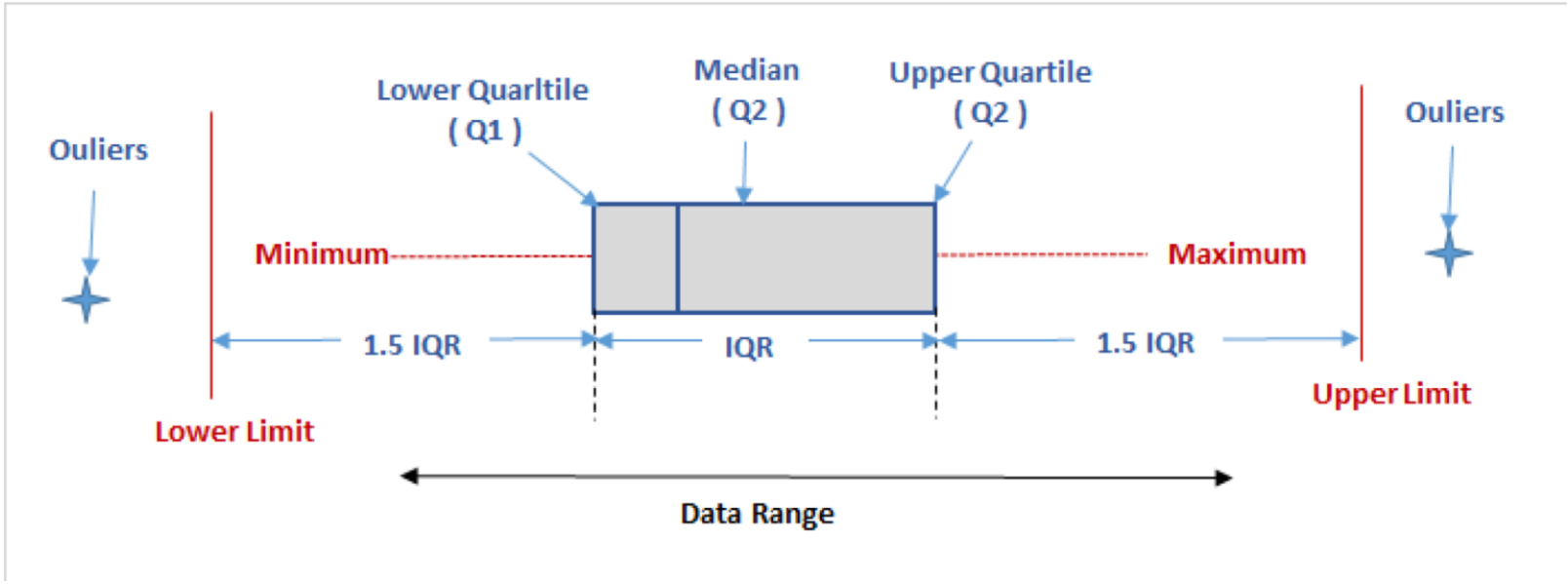
Imputation

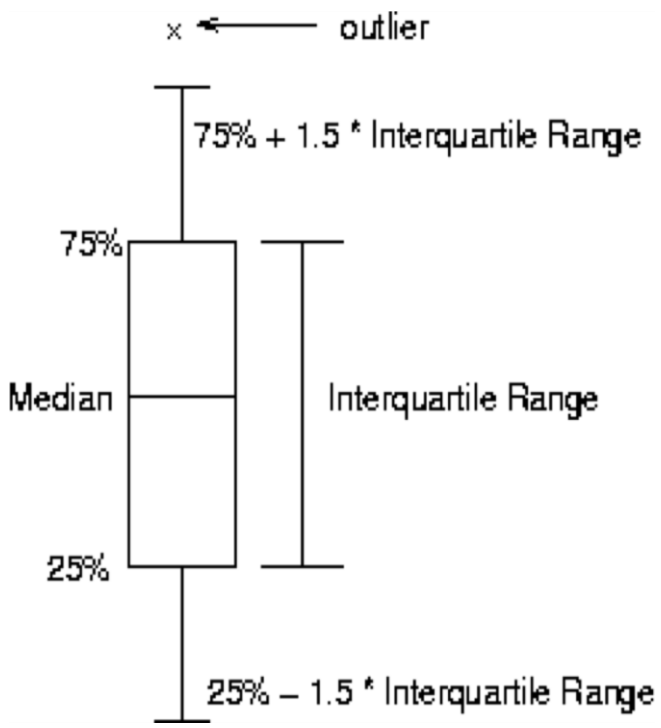
- Replace with mean or a median
- When to use mean?
- Replace with nearest neighbour
- How much nearest to see?

S.No	Qualification	Age	Income
1	B.Tech	25	30k
2	M.Tech	30	50k
3	B.Tech	26	32k
4	B.Tech	25	?
5	M.Tech	29	60k
6	B.Tech	?	30k

Outlier

- BoxPlot





Data Transformation

- Normalization

Min-max normalization

1. Min Max Normalization
2. Z - Score Normalization
3. Decimal scaling

Decimal scaling

v= v/10^j

Normalization: Example II

- **Min-Max normalization on an employee database**
  - max distance for salary: 100000-19000 = 81000
  - max distance for age: 52-27 = 25
  - New min for age and salary = 0; new max for age and salary = 1

$$x'_i = \frac{x_i - \min x_i}{\max x_i - \min x_i}(new\max - new\min) + new\min$$

ID	Gender	Age	Salary
1	F	27	19,000
2	M	51	64,000
3	M	52	100,000
4	F	33	55,000
5	M	45	45,000

ID	Gender	Age	Salary
1	1	0.00	0.00
2	0	0.96	0.56
3	0	1.00	1.00
4	1	0.24	0.44
5	0	0.72	0.32

Normalization: Example

- **z-score normalization: v' = (v - Mean) / Stdev**
- **Example: normalizing the "Humidity" attribute:**

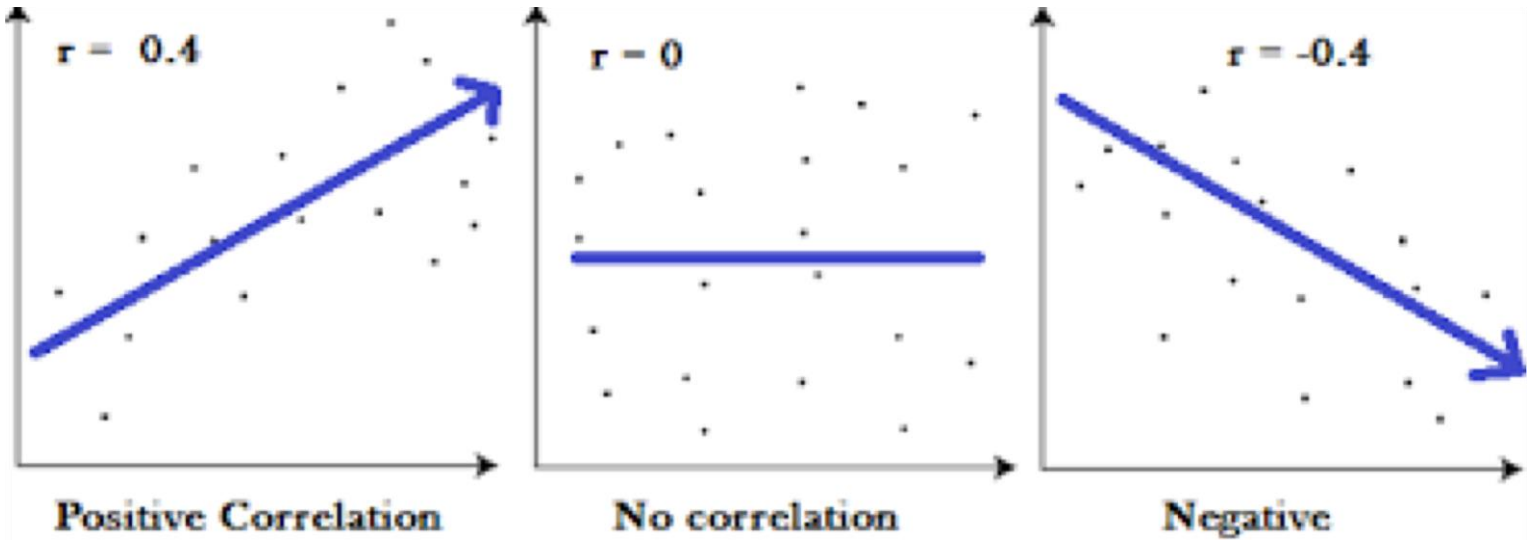
Humidity
85
90
78
96
80
70
65
95
70
80
70
90
75
80

Mean = 80.3
Stdev = 9.84

Humidity
0.48
0.99
-0.23
1.60
-0.03
-1.05
-1.55
1.49
-1.05
-0.03
-1.05
0.99
-0.54
-0.03

Data Integration

- Check for correlation
- Remove uncorrelated data



$$r = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$$

Data Reduction

- Data Cube Aggregation

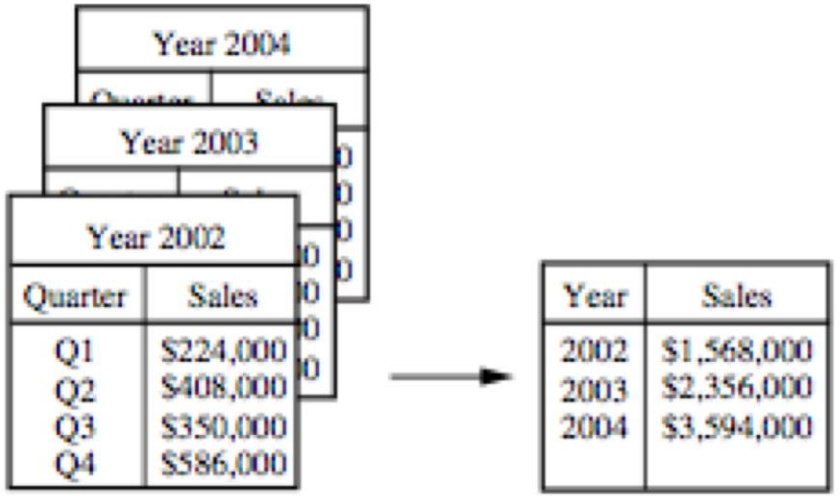


Figure 2.13 Sales data for a given branch of *AllElectronics* for the years 2002 to 2004. On the left, the sales are shown per quarter. On the right, the data are aggregated to provide the annual sales.