

CS685: DATA MINING

DATA PREPROCESSING AND DATA CLEANING

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Data Quality

- Data should have the following qualities
 - Accuracy
 - Completeness
 - Consistency
 - Timeliness
 - Reliability
 - Interpretability
 - Availability

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 - Not continuous in the actual sense
- Data can also be classified in other ways

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- **Nominal**
 - Categories
 - Example: color
 - Operations: equal, not equal
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 - Example: temperature in Kelvin, age, mass, length
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- **Interval-scaled**
 - Measured on equal sized units
 - Example: temperature in Celsius, date
 - No zero point: absolute value has no meaning
 - Operations: difference

important

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- *Domain knowledge* about data and attributes helps data mining

Data Preprocessing

- Data preprocessing is the process of preparing the data to be fit for data mining algorithms and methods
- Known as ETL (Extract, Transform, Load)
- It may involve one or more of the following steps
 - Data cleaning
 - Data reduction/summarization
 - Data integration
 - Data transformation

Data Cleaning

- Process of handling errors in data
- Different ways
- Filling in missing values
- Handling noise
- Removing outliers
 - One of the main methods in handling noise
- Resolving inconsistent data
 - Out of range
 - Once identified as inconsistent data, handled as missing value
- De-duplicating duplicated objects

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- Use the most probable value
 - Mode

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- It is generally assumed that magnitude of noise is smaller than magnitude of attribute of interest
 - Signal-to-noise ratio should not be too low
- White noise
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- Outlier identification and removal

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- Duplicate objects may appear during data insertion or data transfer
- Mostly **due to data collection errors**
- **Introduces errors in statistics about the data**
- If most attributes are exact copies, then it is easy to remove
- Sometimes one or more attributes are slightly different
- *Domain knowledge* needs to be utilized to identify such cases
- Process is called **de-duplication**

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- **Schema matching and entity identification**
 - Is cust_id equal to cust_number?
- Correlation analysis to reduce redundancy
- Chi-square test for categorical data
- De-duplication

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- Smoothing of bins using histograms
- Aggregation and summarization
- Generalization
- Normalization

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- This puts range to $(-\infty, +\infty)$
- Also called **standard score** or **z-score** since it corresponds to the standard normal distribution $N(0, 1)$