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Introduction to data processing and cleaning

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Schedule of today

Morning

- *PRESENTATION:* What is data cleaning and processing?
- *GUIDED WORKSHOP:* COVID and Cognition

Afternoon

- *INDIVIDUAL WORKSHOP*: Dementia and Cognition
- *PRESENTATION*: How to write a report?

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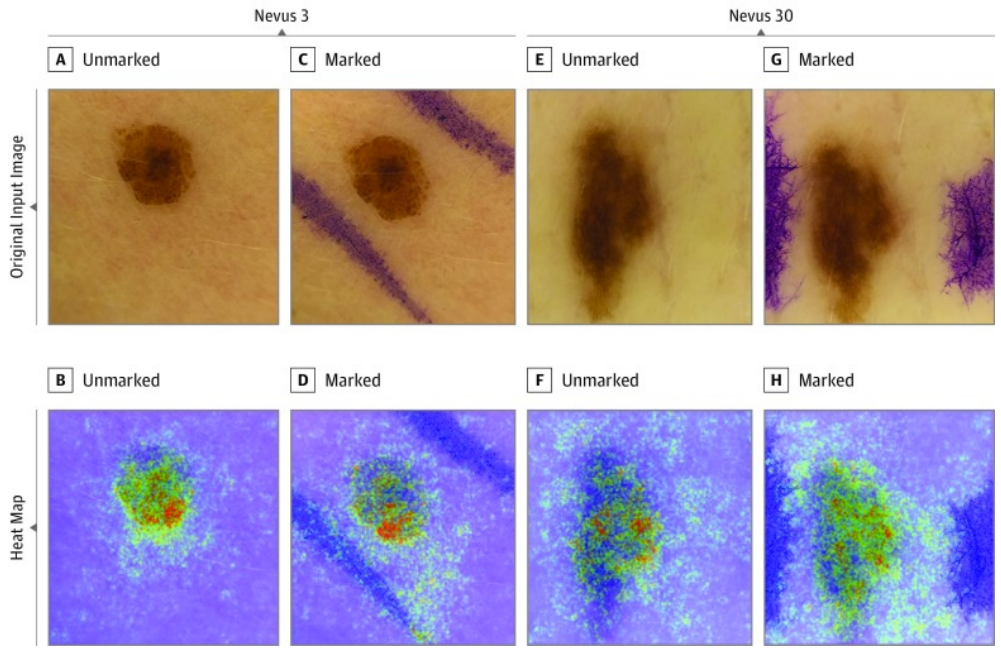
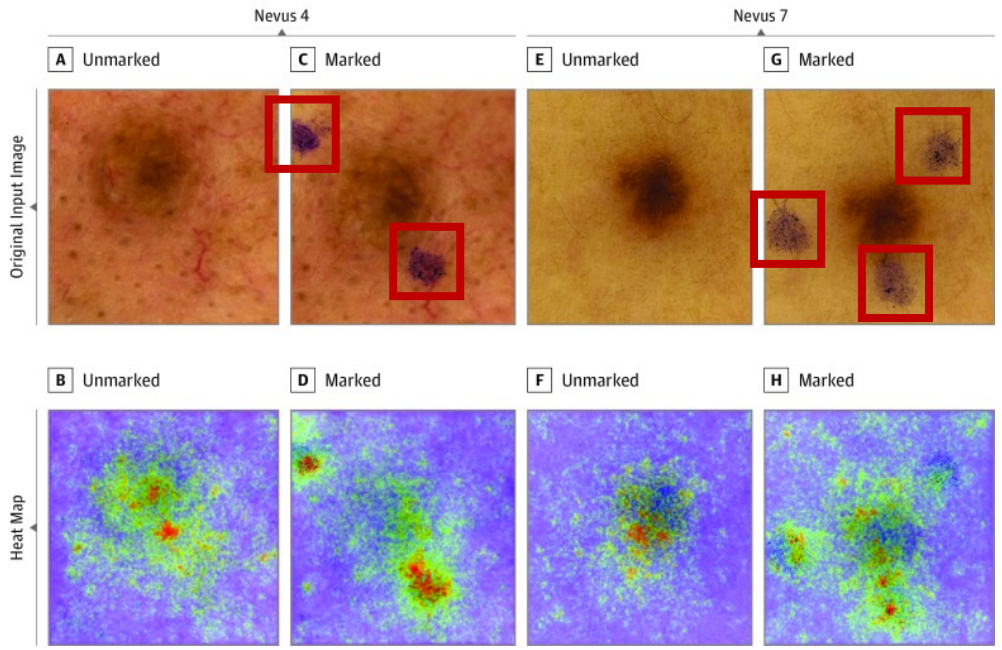
Why is it important?





Machine learning algorithm predicts the marking rather than the melanoma

Winkler et al. 2019

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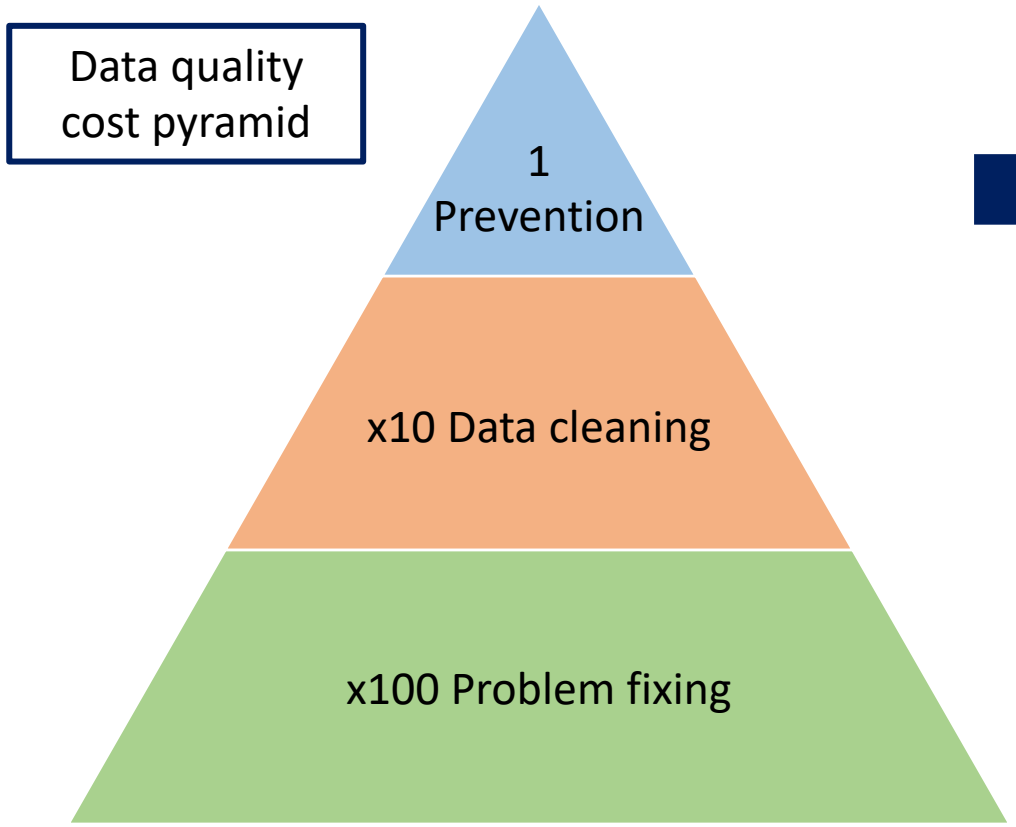
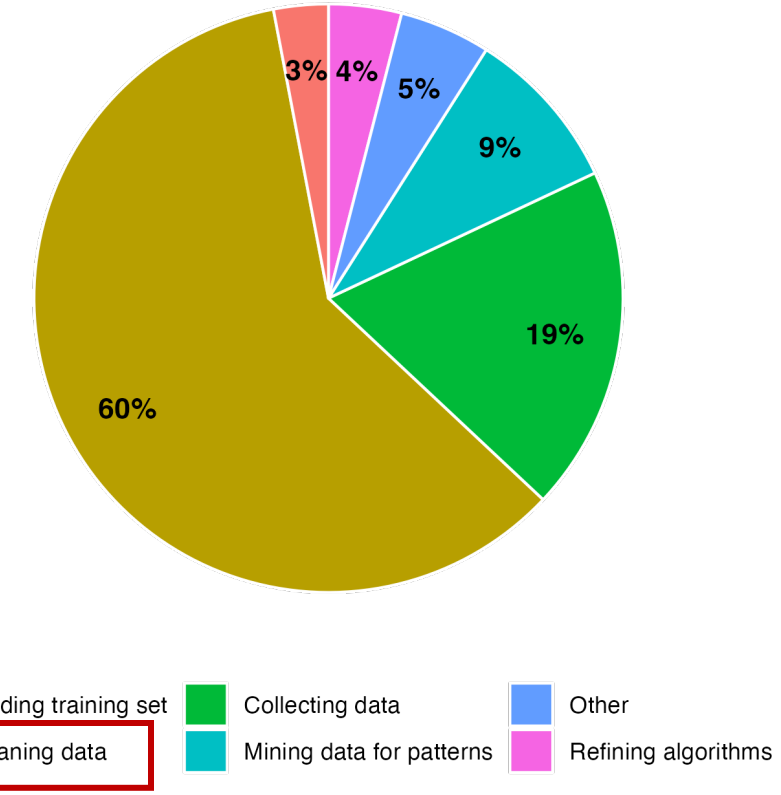
Why is it important?





Sebastianelli et al. 2020

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Data cleaning and processing

DATA CLEANING

Process of fixing and removing incorrect, corrupted, incomplete, duplicated, and incorrectly formatted data from a dataset

VS

DATA PROCESSING

Process of data conversion from a given form to a more easy-to-use one based on the aims of the analysis

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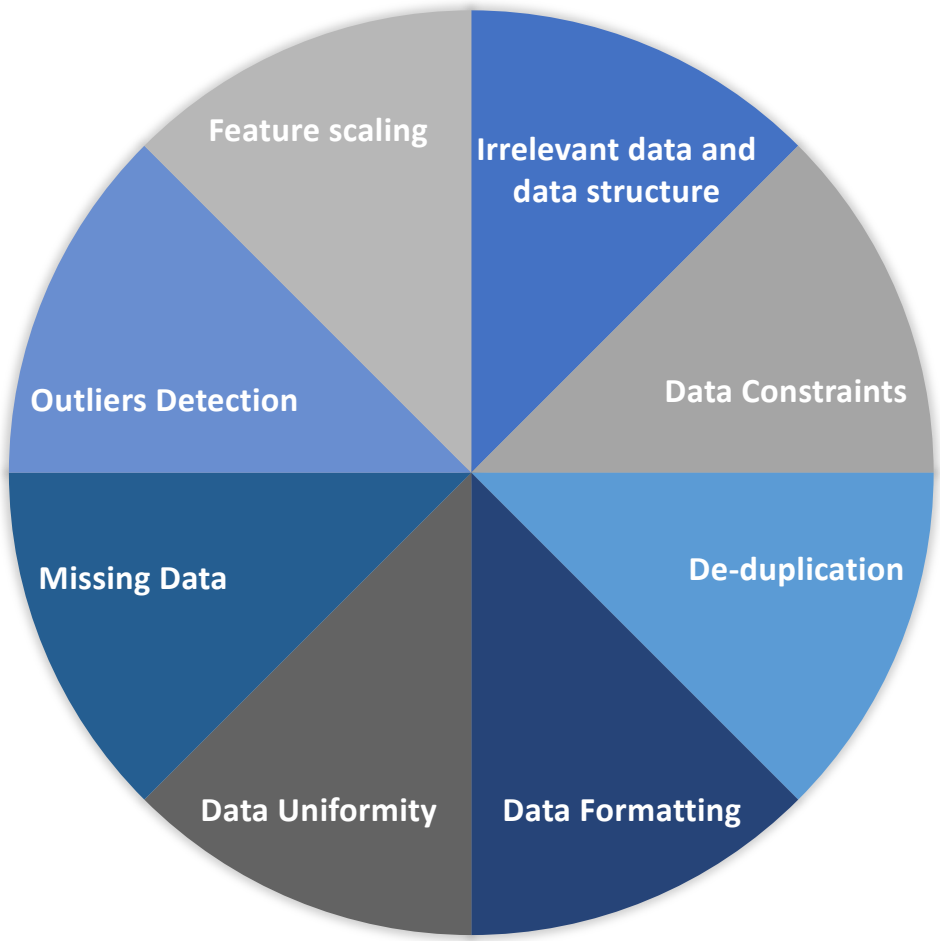

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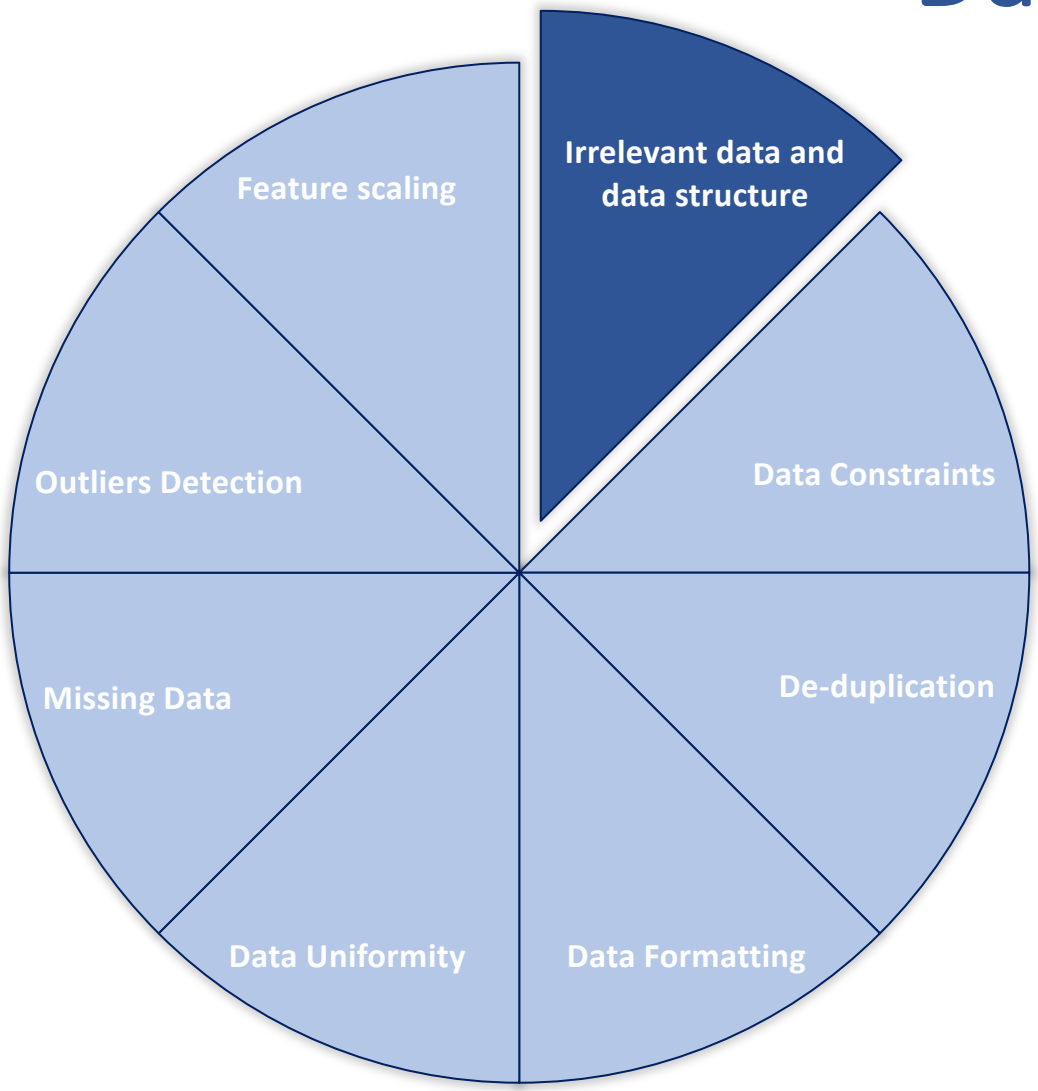
Data cleaning: irrelevant data



Irrelevant data and data structure

?

1. Do you have row and column names?
2. Are column and row names interpretable?
3. Which data do you need for your analysis?

✓

1. Add column and row names
2. Modify column and row names
3. Filter data

Computational resources and interpretability

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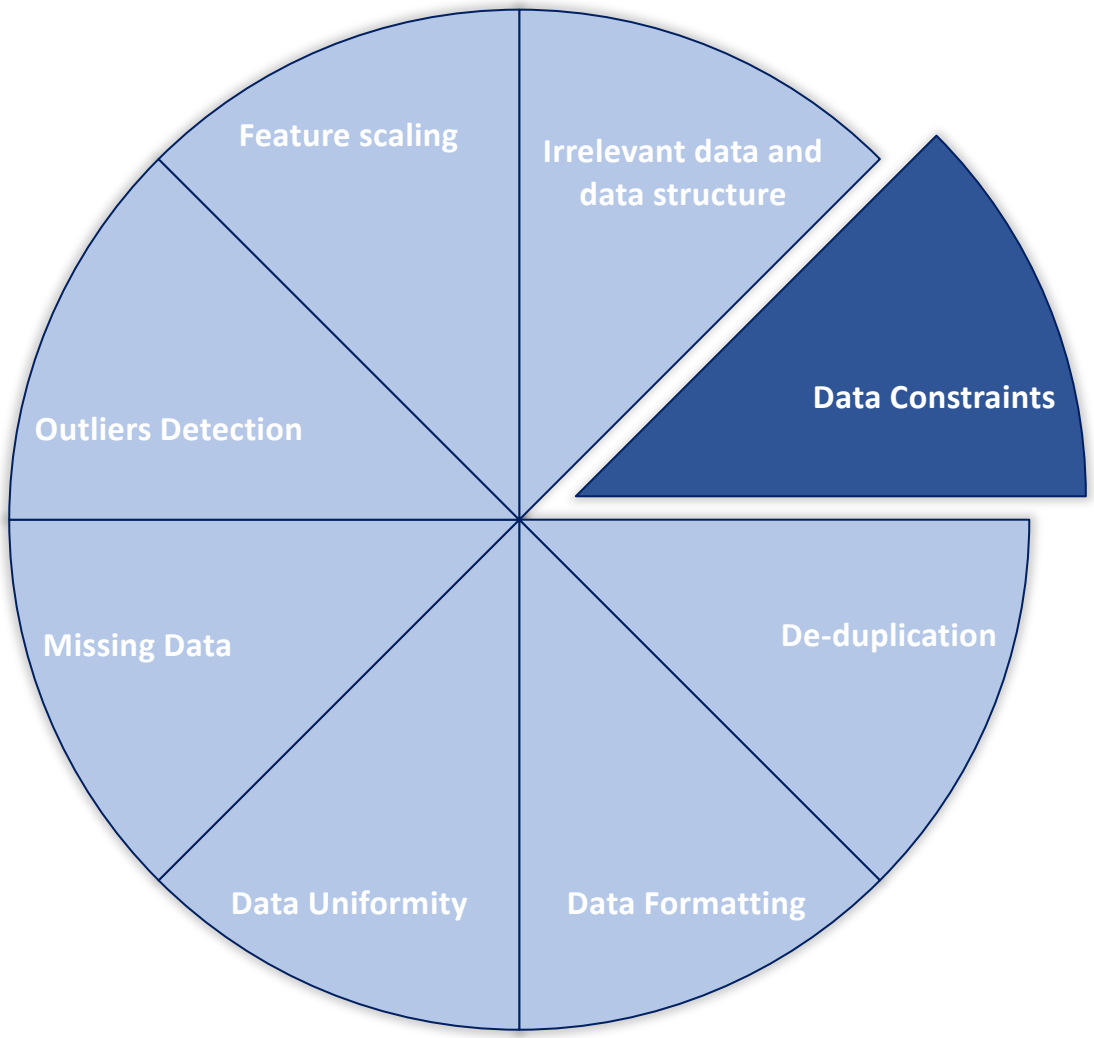
Data cleaning: data constraints



Data Constraints

1. Data Type:
   - Are numerical columns *int* or *float*?
   - Are categorical variables *str*?

2. Data Range:
   - Are the numerical columns within the expected range? (Ex: Age)

1. Convert to proper data types
2. Different solutions:
   1. Set to *NA*
   2. Set equal to *max* or *min*
   3. Remove participants
   4. Check for typing error

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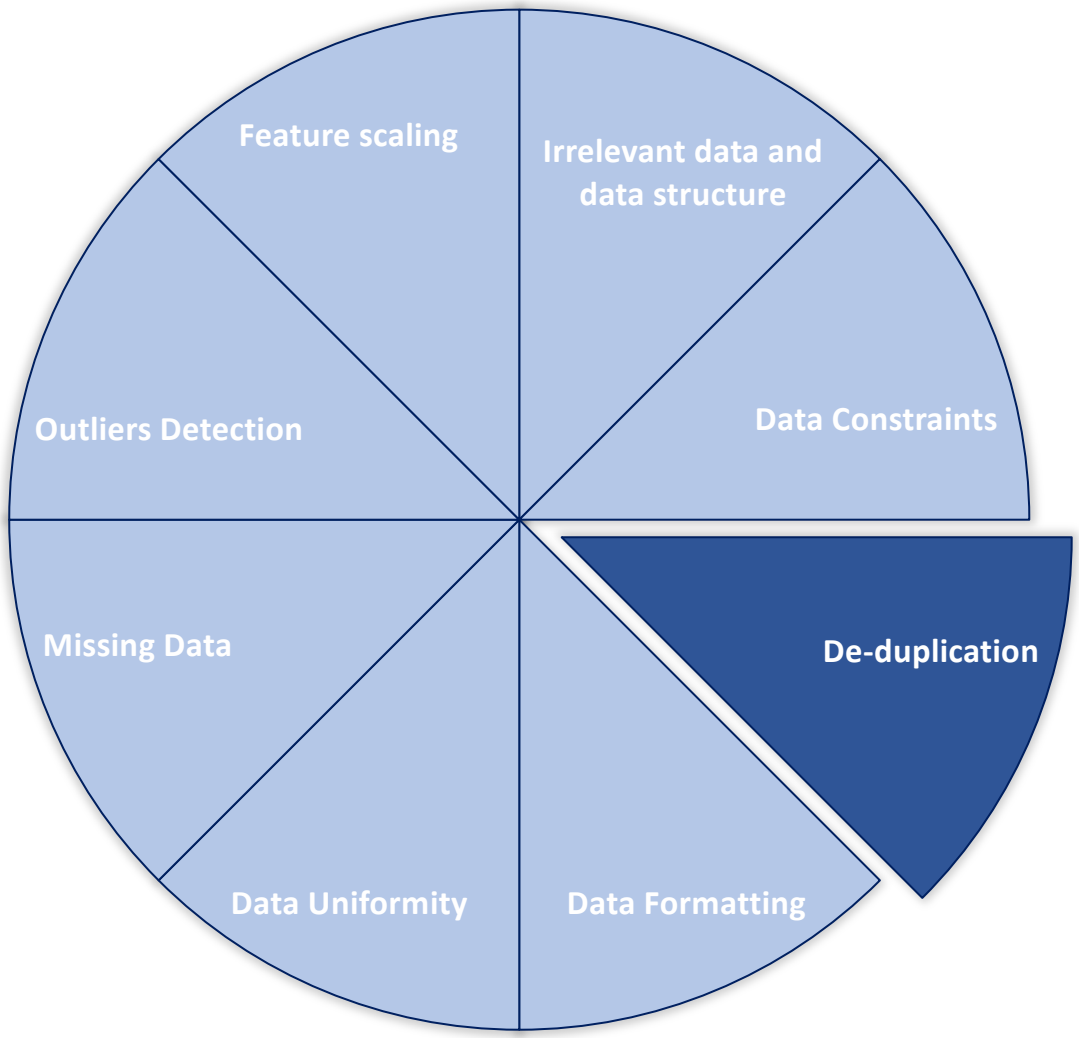
Data cleaning: duplicates



De-duplication

-> Why do you have duplicates?

1. Are there fully duplicated rows?
2. Are there partially duplicates rows?

1. Removal of duplicates
2. Different solutions (depend on WHY):
   - Merge the partial duplicates
   - Remove the partial duplicates
   - Select one of the partial duplicates
   - Keep entry that are duplicates and set rest as *NA*

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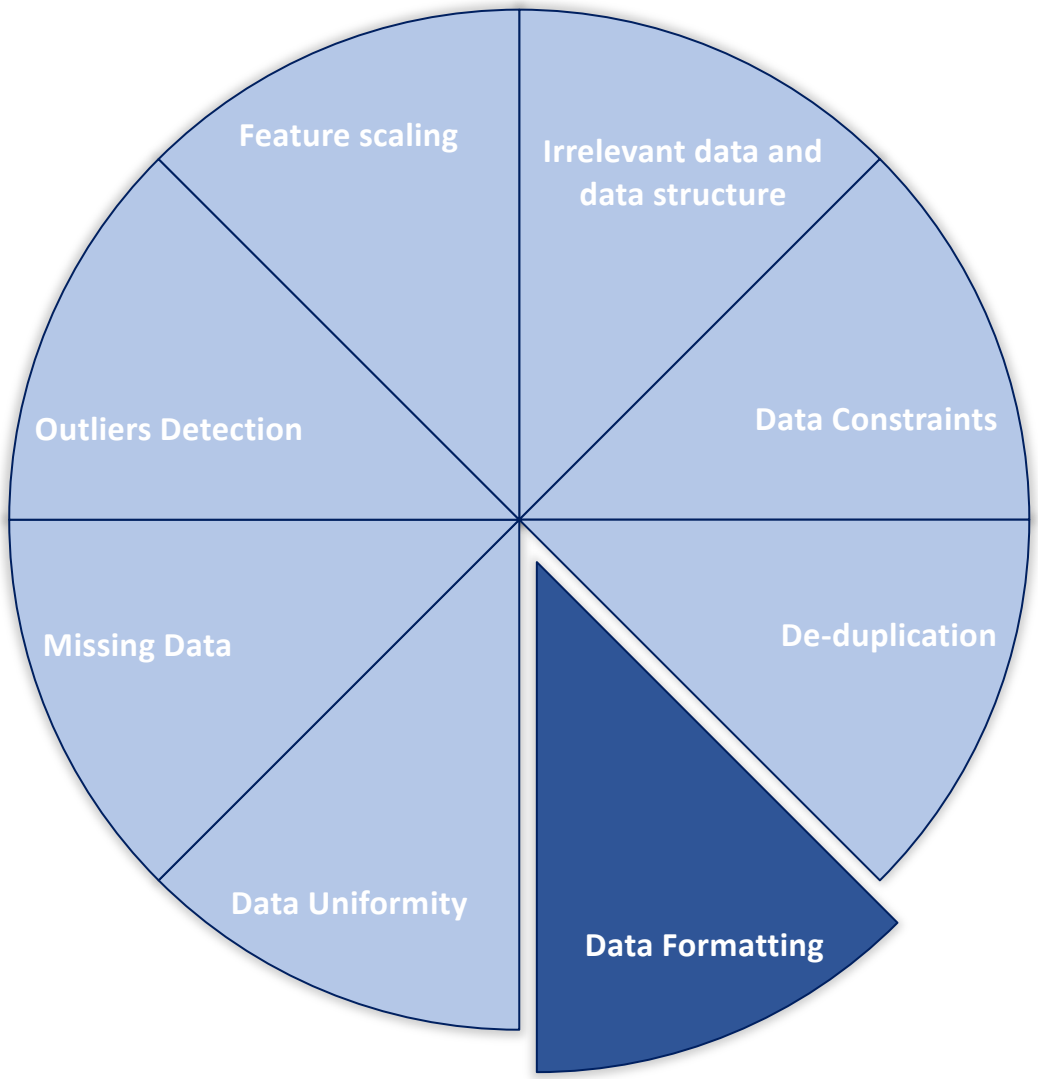
Data cleaning: formatting



Data formatting

?

1. Are there unique names for each category (e.g. Education?)
2. Are text data consistently formatted? (Ex: dates)
3. Are there special characters?

✓

1. Different solutions based on data:
   - Map different categories to unique names
   - Set as NA categories with different formatting (if right category not clear)
   - Infer right category from different data entries
2. Different solutions:
   1. Match right formatting
   2. Set as NA (if not interpretable)
   3. Infer from other data points
3. Remove special characters (iMPORTANT for free text)

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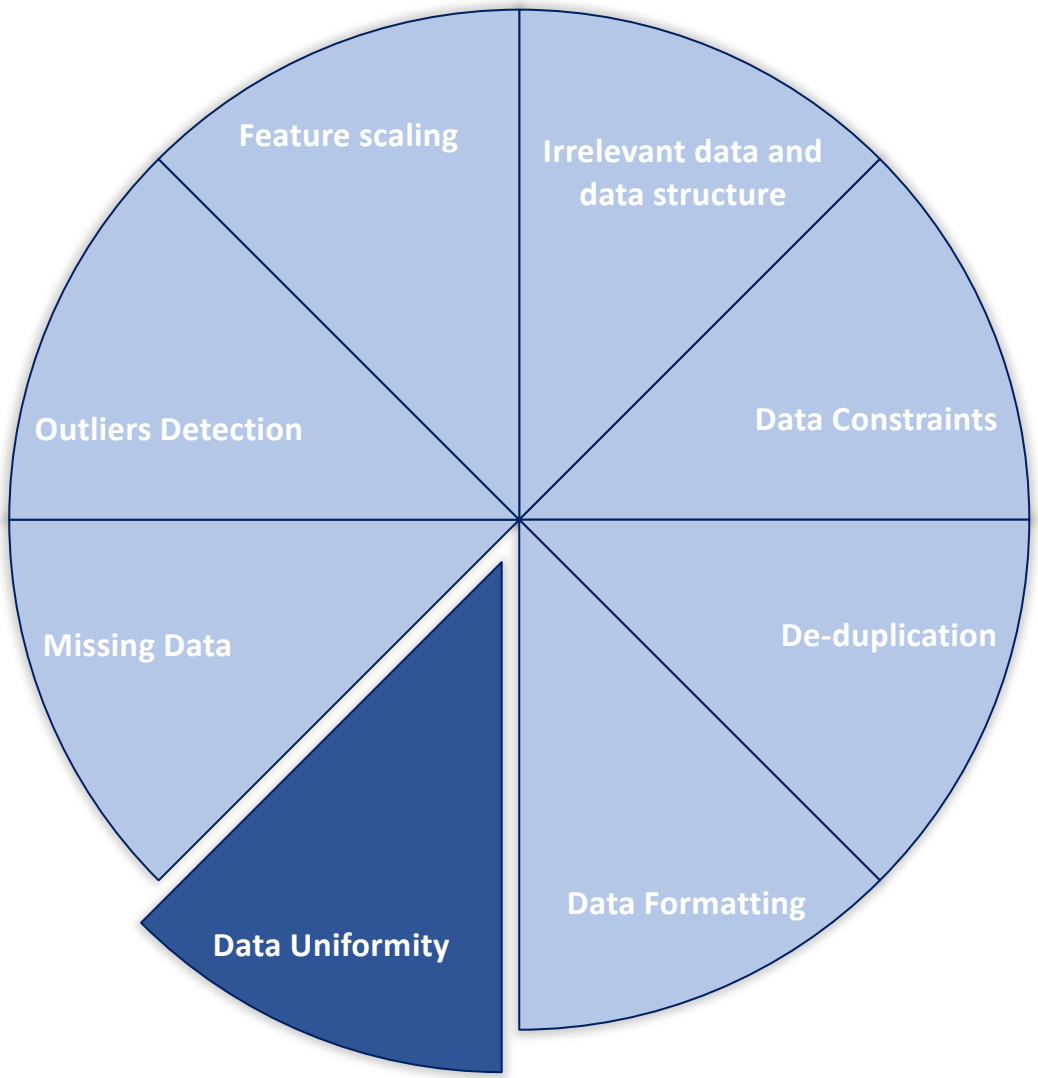
Data cleaning: uniformity



Data Uniformity

1. Do all numerical values have the same units (Ex: ms)?
2. Are columns with similar information consistent (Ex: age and age in decade)?

1. Different solutions:
   - Standardise units (if easy to understand)
   - Set as NA
2. Different solutions:
   - Correct the inconsistent values
   - Set as NA

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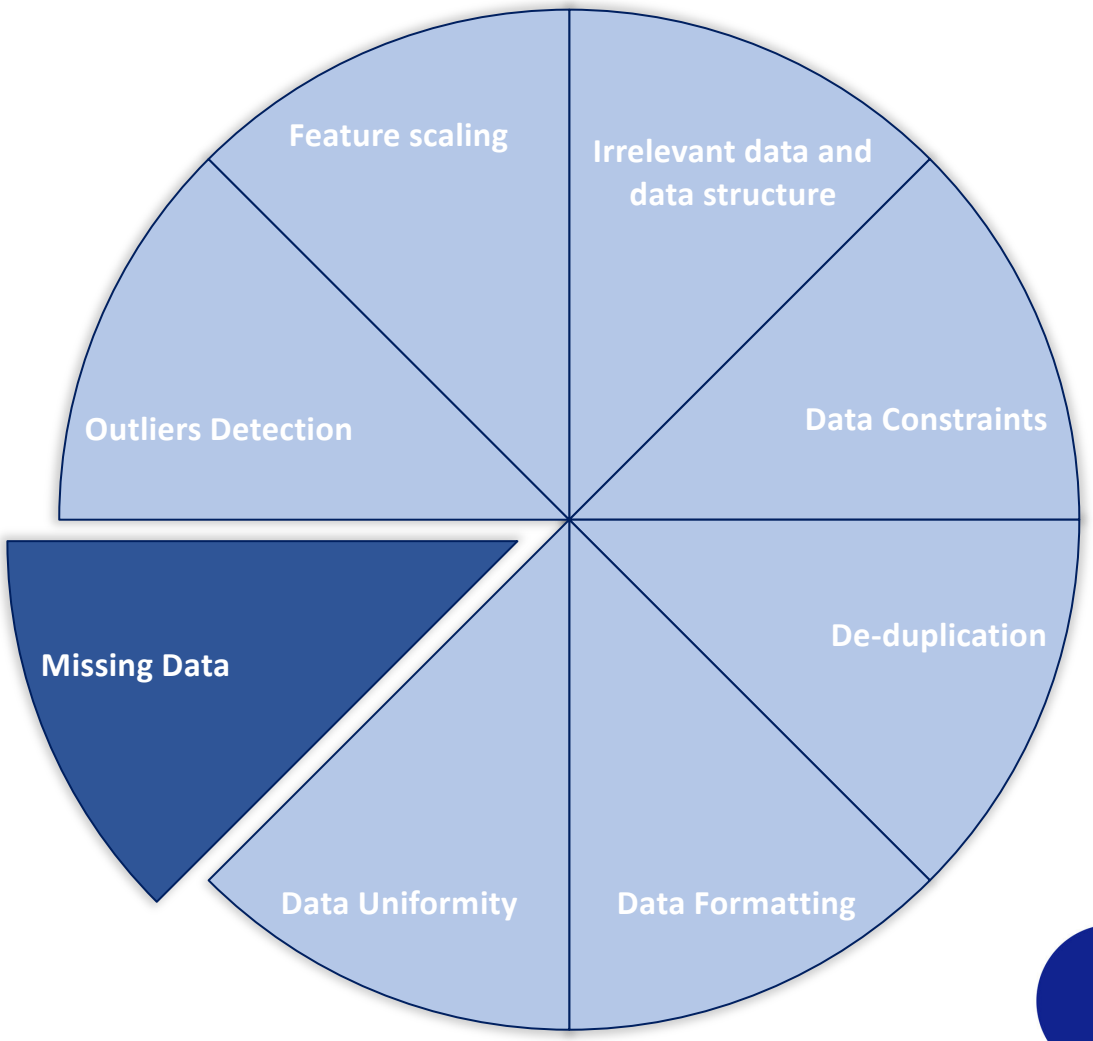
Data cleaning: missing data



Missing data

-> Are the data missing at random or not? Why are they missing?

1. Are there missing data? How many? (IMPORTANT: Always check the number of missing data)

1. Different solutions:
   - Drop participants with more than N *NA*
   - Drop columns with more than N *NA*
   - Impute missing data with mean/median
   - Impute missing data with ML algorithms
   - Infer missing data from other data points

You cannot analyse data if there are missing values

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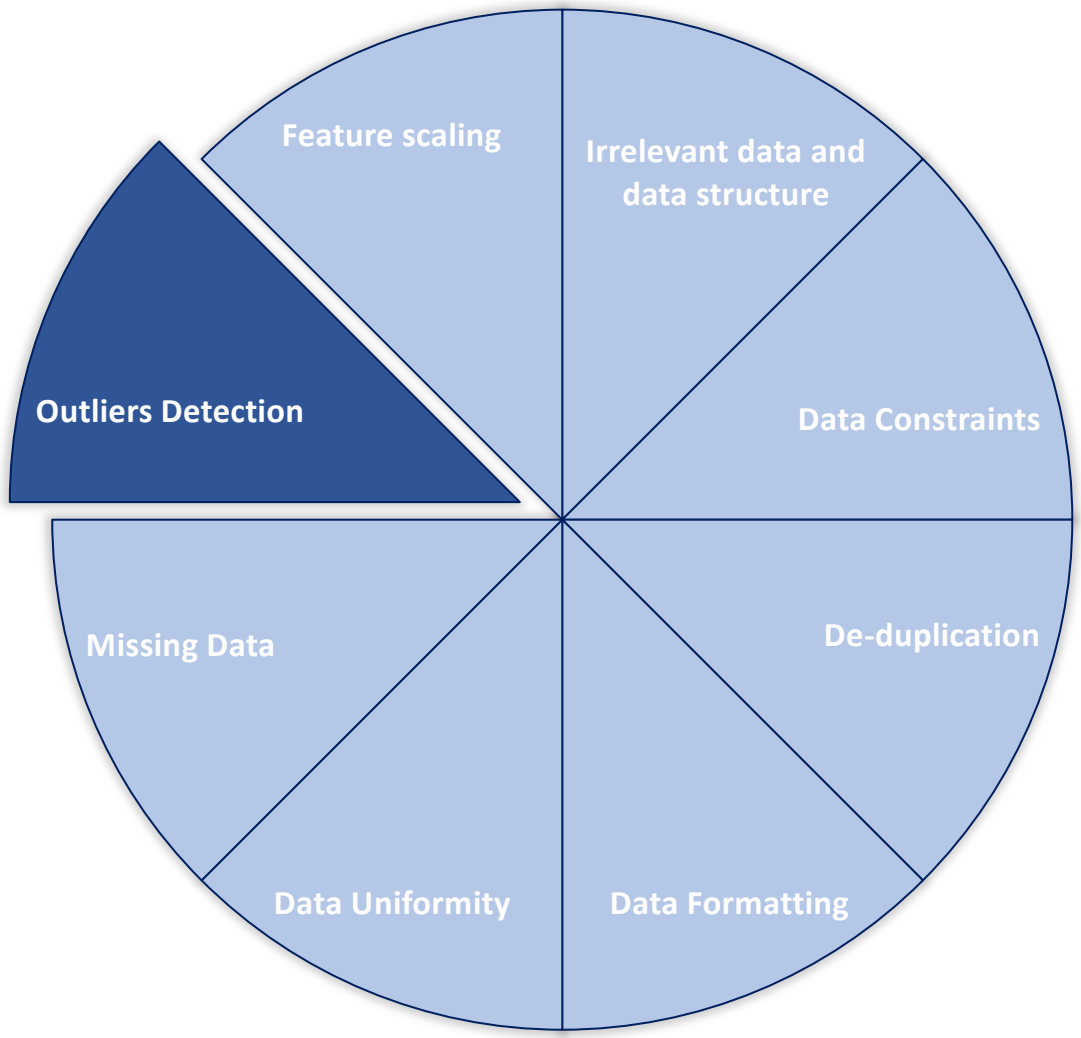
Data cleaning: outliers



Outliers detection

1. Are there outliers? (WHY?)

?

Are they really outliers?

1. Different solutions:
   - Filter out the outliers (e.g. set as NA)
   - Winsorize the outliers
   - Set as mean/median

✓

It really depends on the type of outliers!!

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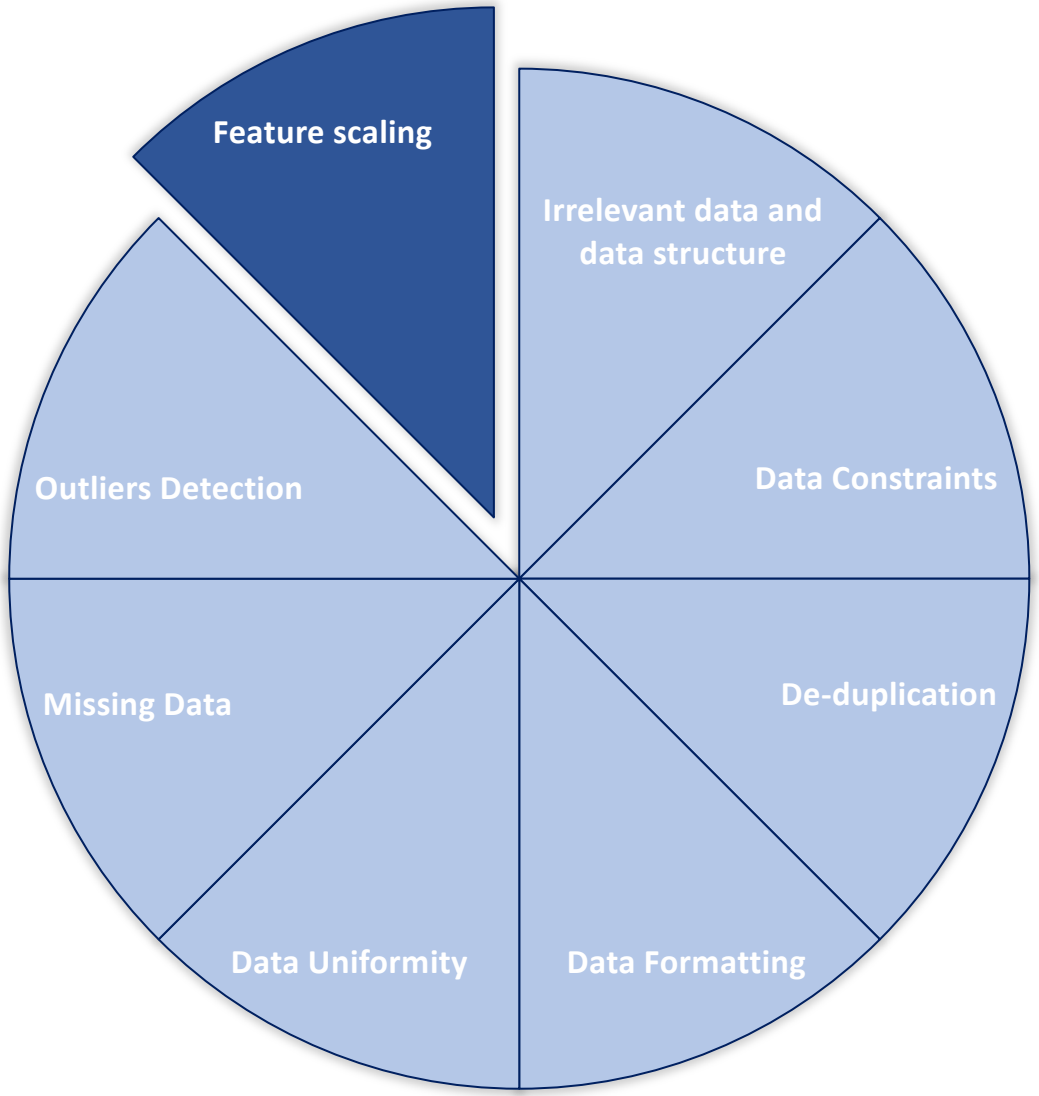
Data cleaning: feature scaling



Feature scaling

1. Are the numerical data properly scaled?

1. Different solutions:
   - Data stadardisation: rescale data to have a mean of 0 and standard deviation of 1
   - Data normalisation: rescale values in a range between 0 and 1

Scaling is really important in Machine learning

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Let's apply what you have learnt to real data!