Data Preprocessing

Project ENABLE

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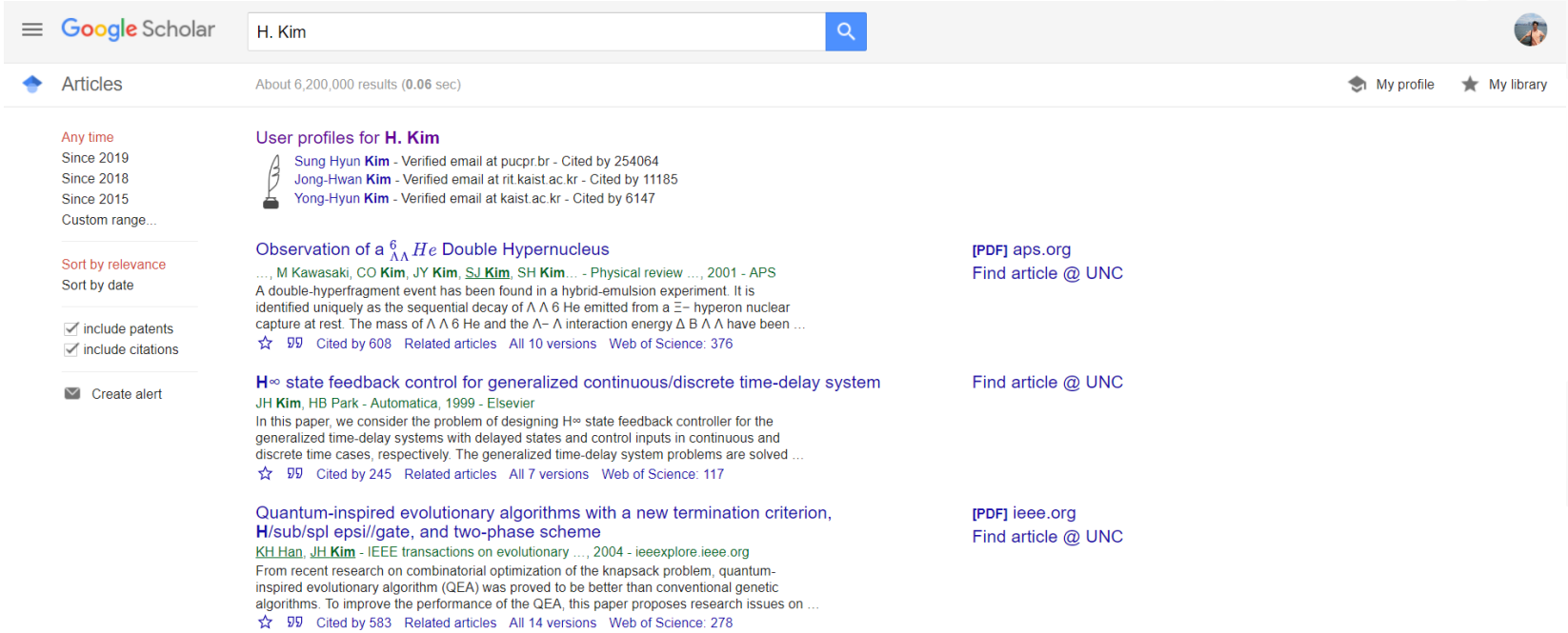
THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

Why Do We Need Data Preprocessing?

- Heejun Kim vs. H. Kim



Data Quality

- Data analysis can be highly vulnerable to noisy, missing, and inconsistent data.
- Today's real-world data likely origin from multiple, heterogenous sources.
- Many reasons for low-quality data (e.g., human error at data entry) and know them is important.
- Data quality should be properly addressed.

Simple Descriptive Analysis for Data Cleaning

- Sort all values in ascending or descending order
  - All values are identical: No information. Ignore this variable.
  - Some values occur abnormally with very high frequency: “Alabama” in 20% cases for the “state” part of addresses.
  - The mode age of respondents is 69 in a student satisfaction survey: Default values of data of birth are 01 (day), 01 (month), and 1950 (year).

Methods for Processing Missing Values

- Ignore the instance: Simplest, but not very effective. In general, this method is not recommended.
- Use a measure of central tendency of the variable (e.g., the mean or median) to fill in the missing value: Use mean for normal data distribution and use median for skewed data distribution.
  - Good if the data distribution for a variable is centered or skewed.
  - Meh if the data distribution is more evenly distributed.
- Use the most probable value (imputation)
  - Use regression, inference-based tools based on a Bayesian formalism, or decision tree induction.
  - This approach uses the most information from the available data.

Methods for Processing Noisy Values

- Problem with an extreme outlier. For instance, the department at UNC which has the highest average annual income of alumni is “Geography.”
- Binning: sort values and put them into a number of “buckets,” or bins. This approach basically utilize the values of the neighborhood and perform local smoothing.
- Remove outliers
  - Remove instances whose values are more than two standard deviations away from the mean for a given attribute.
  - Create clusters to put similar values into groups, or “clusters.” Remove instances whose values fall outside of the created clusters.

An Example of Binning

- Sorted data for medical expenditure (in dollars):
  104429, 105405, 111544, 121635, 132497, 135662, 153429, 160648, 174984
- Partition into bins
  - Bin 1: 104429, 105405, 111544
  - Bin 2: 121635, 132497, 135662
  - Bin 3: 153429, 160648, 174984
- Smoothing by bin means
  - Bin 1: 107126
  - Bin 2: 129931.3
  - Bin 3: 163020.3

Data Integration

- Data integration is processes to combine data from disparate sources into a unified view of data.
- Potential problems
  - Redundancies and inconsistencies in the resulting dataset.
  - Entity Identification Problem: Different names (e.g., patient_id vs. id) used for the same concept in different databases.
  - Data value conflict (e.g., Heejun vs. H.).
  - Instance duplication

Any Questions?

Bivariate Analysis

Next Class

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