Discovering Nulls and Outliers

DS-1004 Big Data

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MINIMIZERS

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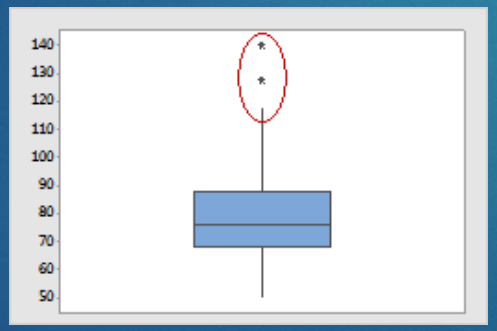
https://github.com/ranamihir/big_data_project

INTRODUCTION

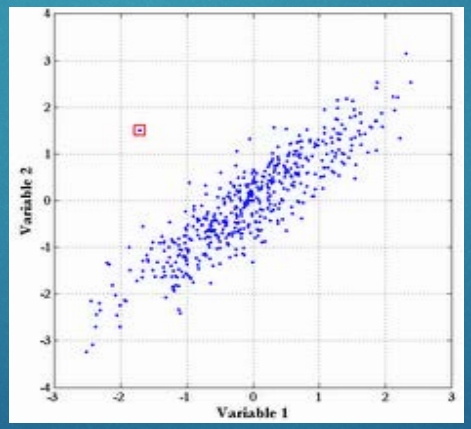
- Problem Statement:
  1. Null Value Detection
  2. Outlier Detection
     - Univariate outliers
     - Multivariate outliers
- Data Set Collection:
  - NYC Open Data
  - 50 data sets

PROBLEM FORMULATION

1. Data Cleaning
   - "$1.99" → 1.99, "1,000" → 1000, 10003 → "10003" (zip code)
2. Missing Value Treatment
   - "None", "N/A", " ", "-", "-999", "999", etc.
3. Outliers



Source: link



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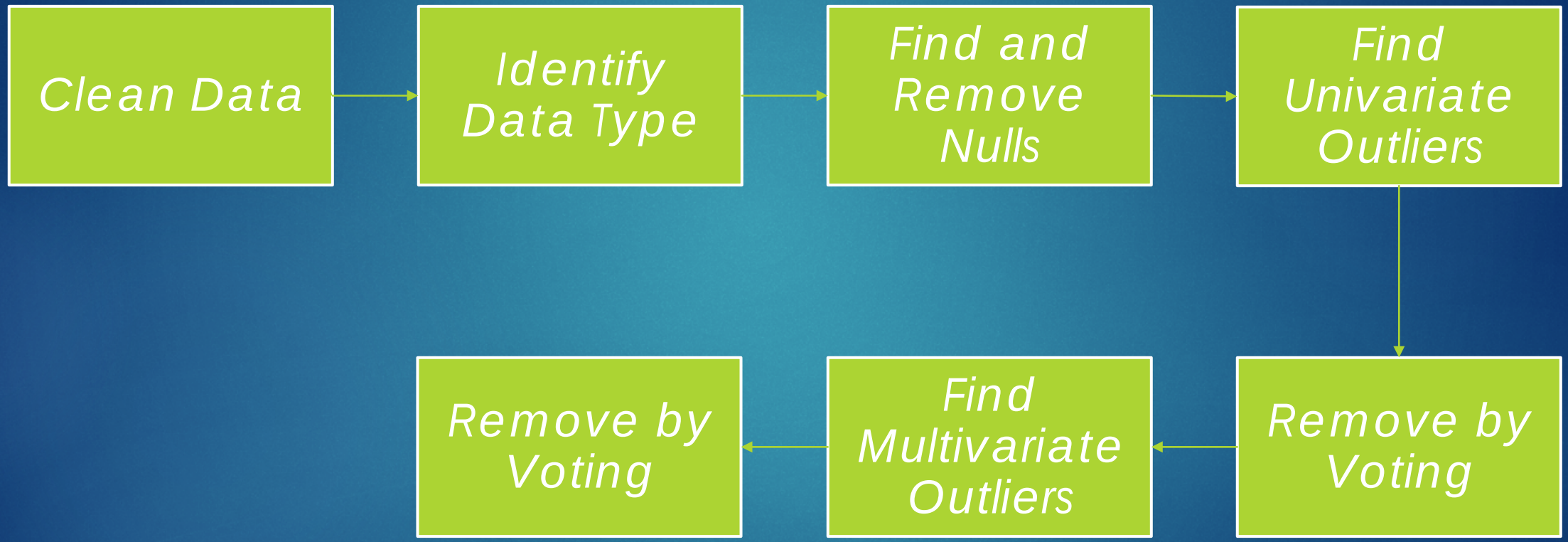
METHODOLOGY



OUTLIER DETECTION

- *Nearest Neighbor based*
  - *DBSCAN*
- *Clustering based*
  - *k-Means*
- *Mixture of Parametric Distributions*
  - *Gaussian Mixture Models*

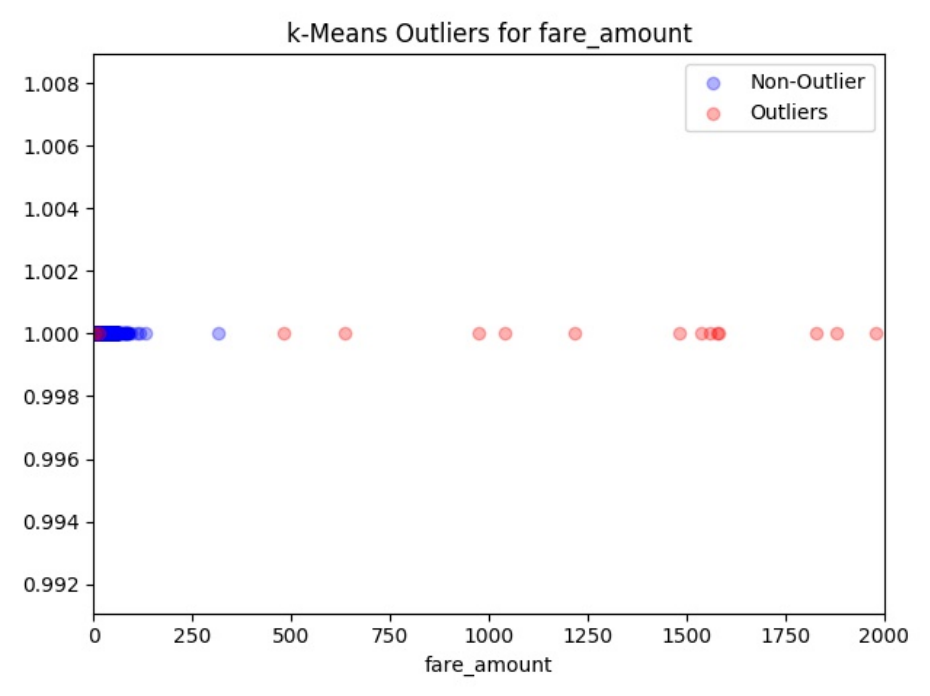
OUTLIER DETECTION

- Non-Parametric
  - Histogram / frequency – based
- Statistical Anomaly based
  - Box plot Rule
  - Gaussian model based (z-score)
  - Other Probabilistic models (Beta, Gamma, etc.)

KEY STRENGTHS

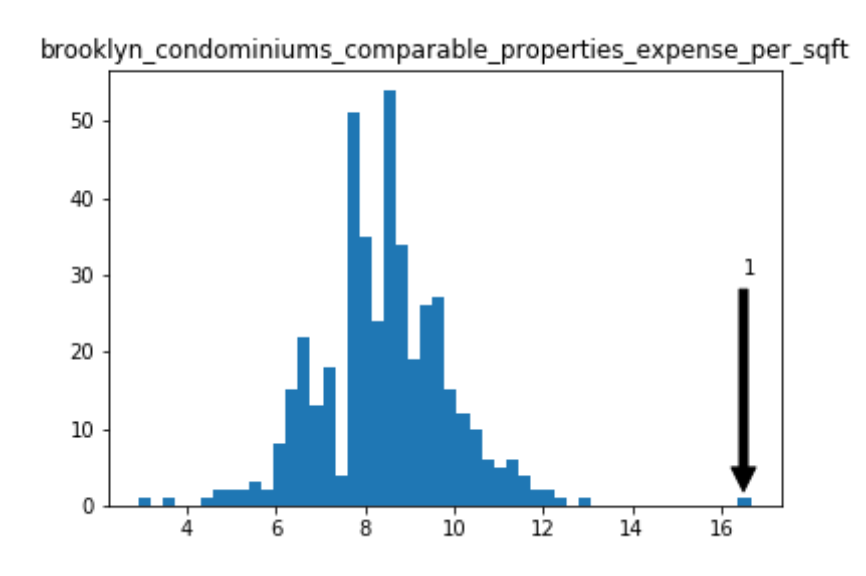
- End-to-end automated framework
- Box plot Rule at core
  - No input specific to particular data set / column required
- Robust
  - Multiple techniques optimizing different metrics
  - Voting / Intersection of multiple similar techniques
- Efficient
  - Remove univariate outliers before finding multivariate ones

RESULTS



Column	Value
brooklyn_ condominiums_ comparable_ properties_ address	"5 UNKNOWN"

Data: bss9-579f.tsv



Summary	num_level_3
count	5302
Mean	239.776
stddev	267.144
min	0.0
max	2020.0

rid	num_level_3
847	1386.0
851	1434.0
963	1337.0
990	1344.0
1493	1522.0

Data: usap-qc7e.tsv

REFERENCES

1. Jason Brownlee. 2016. How To Handle Missing Values In Machine Learning Data With Weka. (Jun 2016). https://machinelearningmastery.com/ how-to-handle-missing-values-in-machine-learning-data-with-weka/
2. Varun Chandola, Arindam Banerjee, and Vipin Kumar. 2007. Anomaly Detection: A Survey. (2007).
3. Google. 2018. Locate Outliers, Google Cloud Dataprep Documentation, Google Cloud. (2018). https://cloud.google.com/dataprep/docs/html/Locate-Outliers_ 57344572
4. Ming Hua and Jian Pei. 2007. Cleaning Disguised Missing Data: A Heuristic Approach. In Proceedings of the 13th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD '07). ACM, New York, NY, USA, 950–958. https://doi.org/10.1145/1281192.1281294
5. Ming Hua and Jian Pei. 2008. DiMaC: a disguised missing data cleaning tool. In KDD.
6. Sridhar Ramaswamy, Rajeev Rastogi, and Kyuseok Shim. 2000. Efficient Algorithms for Mining Outliers from Large Data Sets. SIGMOD Rec. 29, 2 (May 2000), 427–438. https://doi.org/10.1145/335191.335437