Group of
Horribly
Optimistic
STatisticians

# Data Manipulation

## Intro to Data Science

Maksymilian Norkiewicz & Jędrzej Ogrodowski

# File Formats

# .CSV


```
"name","surname","email","phone"
"Herminia","Marshall","herminia.marshall@example.com","678-313-8625"
"Bernice","Richardson","bernice.richardson@example.com","406-640-0952"
"Maeleachlainn","Albertson","maeleachlainn.albertson@example.com","936-514-5533"
"Laloecen","Darwin","laloecen.darwin@example.com","772-216-4633"
"Shib","Payton","shib.payton@example.com","817-657-1845"
"Marcos","Bertolini","marcos.bertolini@example.com","209-977-7112"
"Daniël","Teague","daniël.teague@example.com","773-750-0852"
"Ikaros","Garber","ikaros.garber@example.com","615-289-1387"
"Regulus","Cornell","regulus.cornell@example.com","832-572-5442"
"Lars","Simen","lars.simen@example.com","843-441-7001"
```

# .tsv


```
"name"	"surname"	"email"	"phone"
"Herminia"	"Marshall"	"herminia.marshall@example.com"	"678-313-8625"
"Bernice"	"Richardson"	"bernice.richardson@example.com"	"406-640-0952"
"Maeleachlainn"	"Albertson"	"maeleachlainn.albertson@example.com"	"936-514-5533"
"Laloecen"	"Darwin"	"laloecen.darwin@example.com"	"772-216-4633"
"Shib"	"Payton"	"shib.payton@example.com"	"817-657-1845"
"Marcos"	"Bertolini"	"marcos.bertolini@example.com"	"209-977-7112"
"Daniël"	"Teague"	"daniël.teague@example.com"	"773-750-0852"
"Ikaros"	"Garber"	"ikaros.garber@example.com"	"615-289-1387"
"Regulus"	"Cornell"	"regulus.cornell@example.com"	"832-572-5442"
"Lars"	"Simen"	"lars.simen@example.com"	"843-441-7001"
```

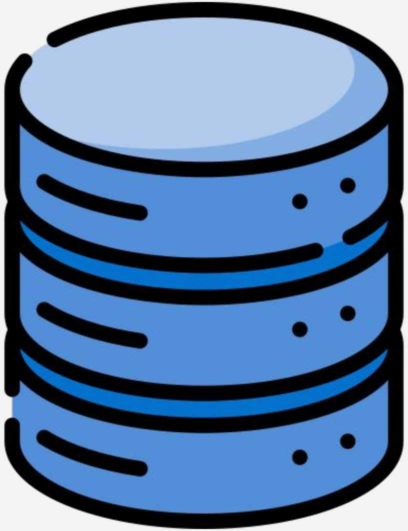
# .json


```json
{
        "name": [
                "Herminia",
                "Bernice",
                "Maeleachlainn",
                "Laloeocen",
                "Shib",
                "Marcos",
                "Dani\u00ebl",
                "Ikaros",
                "Regulus",
                "Lars"
        ],
        "surname": [
                "Marshall",
                "Richardson",
                "Albertson",
                "Darwin",
                "Payton"
```

# .xlsx


| | A | B | C | D |
|---|---|---|---|---|
| 1 | **name** | **surname** | **email** | **phone** |
| 2 | Herminia | Marshall | herminia.marshall@example.com | 678-313-8625 |
| 3 | Bernice | Richardson | bernice.richardson@example.com | 406-640-0952 |
| 4 | Maeleachlainn | Albertson | maeleachlainn.albertson@example.com | 936-514-5533 |
| 5 | Laloeocen | Darwin | laloeocen.darwin@example.com | 772-216-4633 |
| 6 | Shib | Payton | shib.payton@example.com | 817-657-1845 |
| 7 | Marcos | Bertolini | marcos.bertolini@example.com | 209-977-7112 |
| 8 | Daniël | Teague | daniel.teague@example.com | 773-750-0852 |
| 9 | Ikaros | Garber | ikaros.garber@example.com | 615-289-1387 |
| 10 | Regulus | Cornell | regulus.cornell@example.com | 832-572-5442 |
| 11 | Lars | Simen | lars.simen@example.com | 843-441-7001 |
| 12 | | | | |

# SQL



```
conn = sql.connect("path/to/file/users.db")
data_sql = pd.read_sql("SELECT * FROM users;", conn)
conn.close()
```

# How to assess data quality

DATA SCIENCE JOURNAL

Cai, L and Zhu, Y 2015 The Challenges of Data Quality and Data Quality Assessment in the Big Data Era. *Data Science Journal,* 14: 2, pp. 1-10, DOI: http://dx.doi.org/10.5334/dsj-2015-002

PROCEEDINGS PAPER

# The Challenges of Data Quality and Data Quality Assessment in the Big Data Era

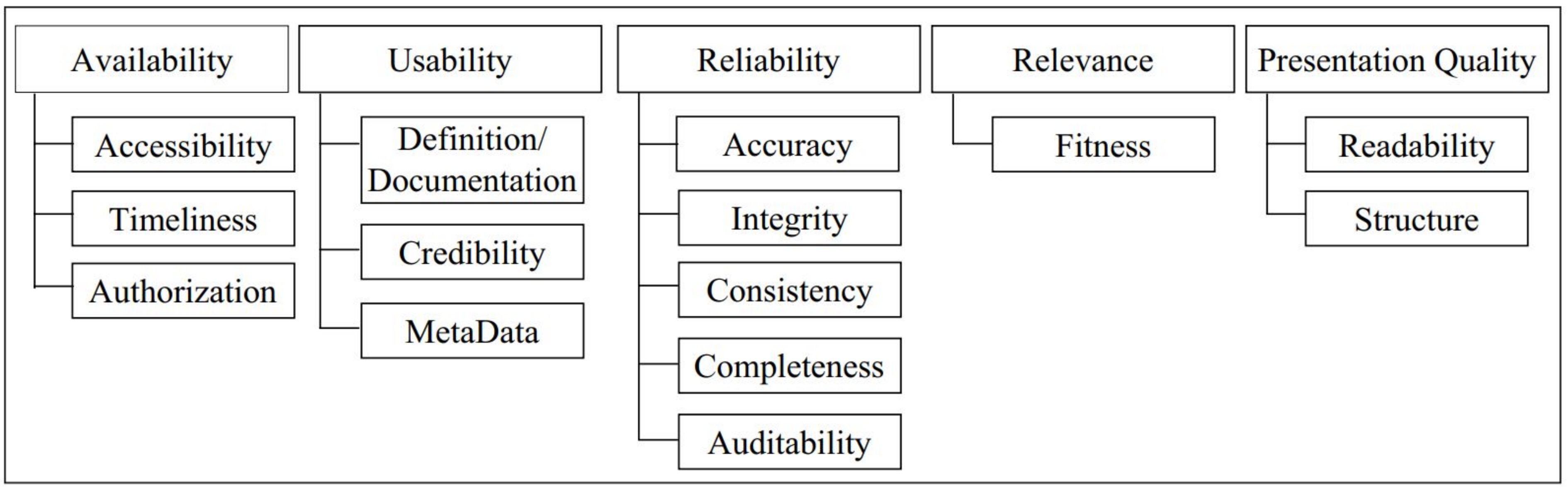
Li Cai[1,3] and Yangyong Zhu[2]

[1] School of Computer and Science, Fudan University, No. 220, Han Dan Road, Shanghai, China
lcai@fudan.edu.cn

[2] Shanghai Key Laboratory of Data Science, Fudan University, Shanghai, China
yyzhu@fudan.edu.cn

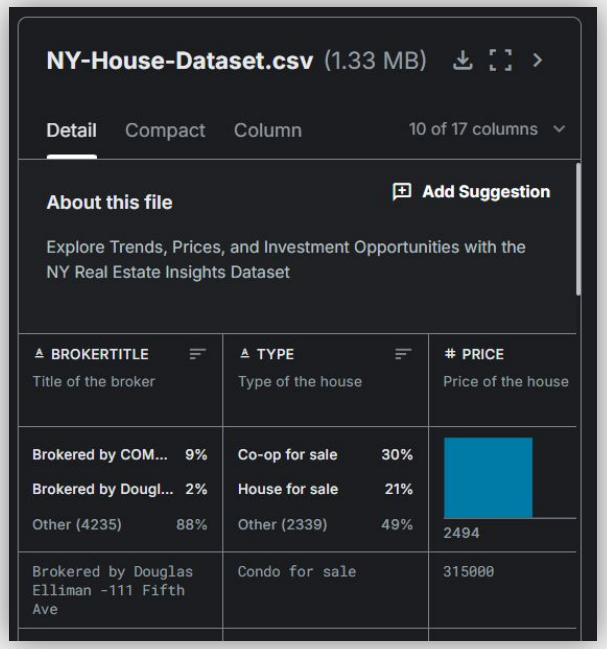
[3] School of Software, Yunnan University, No. 2 North Road of Cui Hu, Kunming, China

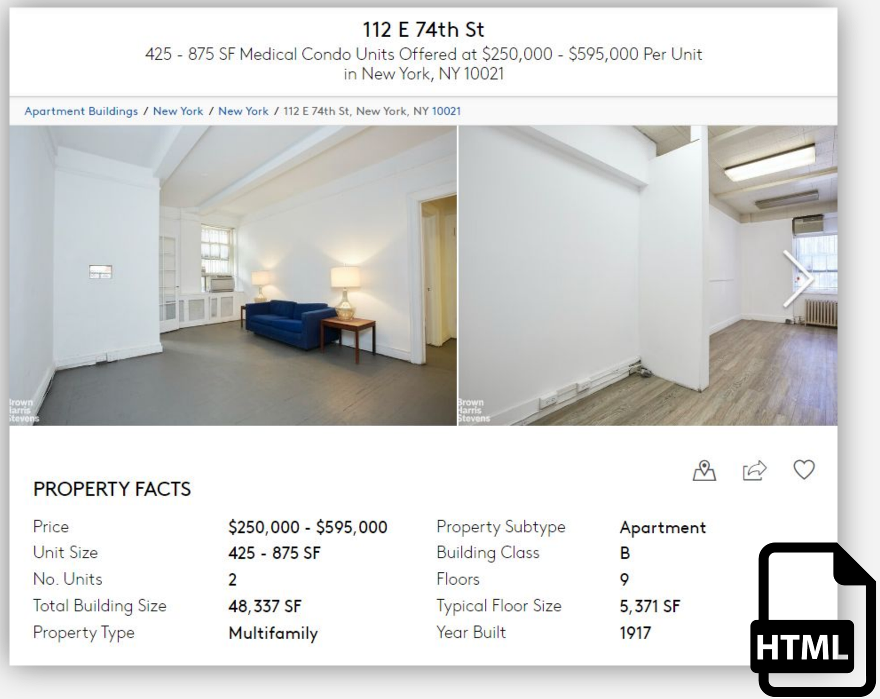
High-quality data are the precondition for analyzing and using big data and for guaranteeing the value of the data. Currently, comprehensive analysis and research of quality standards and quality assessment methods for big data are lacking. First, this paper summarizes reviews of data quality research. Second, this paper analyzes the data characteristics of the big data


Availability
Accessibility
Timeliness
Authorization
Usability
Definition/
Documentation
Credibility
MetaData
Reliability
Accuracy
Integrity
Consistency
Completeness
Auditability
Relevance
Fitness
Presentation Quality
Readability
Structure

# Availability

# Accessibility



# Timeliness

# Timeliness

# Timeliness


2012
My super model
for predicting
house prices
My data 🙁
2025

# Authorization

otodom Analytics

# Authorization

otodom Analytics

**1899 zł** /30 dni

dostępny dla deweloperów współpracujących z obido

# Authorization

## 2. Postanowienia Ogólne

3. Treści publikowane w Serwisie, w tym w szczególności Ogłoszenia, niezależnie od ich formy, tj. materiały tekstowe, graficzne oraz wideo, są przedmiotem ochrony praw własności intelektualnej, w tym prawa autorskiego oraz praw własności przemysłowej, Grupy OLX, Użytkowników lub osób trzecich. Zabrania się w szczególności:
   a. jakiegokolwiek wykorzystywania tych treści bez pisemnej zgody uprawnionych;
   b. jakiegokolwiek agregowania i przetwarzania danych oraz innych informacji dostępnych w Serwisie w celu ich dalszego udostępniania osobom trzecim w ramach innych serwisów internetowych jak i poza Internetem;
   c. wykorzystywania oznaczeń Serwisu oraz Grupy OLX, w tym charakterystycznych elementów grafiki bez zgody Grupy OLX.

# Usability

# Definition/ Documentation

## About this Dataset

Updated
**January 19, 2023**

| Data Last Updated | Metadata Last Updated |
|---|---|
| December 5, 2022 | January 19, 2023 |

**Date Created**
April 28, 2020

| Views | Downloads |
|---|---|
| 14.7K | 2,358 |

### Data Collection

| | |
|---|---|
| Data Collection | COVID-19 Health Data |

### Dataset Information

| | |
|---|---|
| Agency | Department of Health and Mental Hygiene (DOHMH) |

### Update

| | |
|---|---|
| Update Frequency | Daily |
| Automation | Yes |
| Date Made Public | 5/19/2020 |

# Definition/ Documentation

## Columns (6)

| Column Name | Description | API Field Name | Data Type |
|---|---|---|---|
| extract_date | Date of data extraction | extract_date | Floating Timestamp |
| date | Date of emergency department visit | date | Floating Timestamp |
| mod_zcta | Modified ZIP Code tabulation area (ZCTA) of patient residence | mod_zcta | Text |
| total_ed_visits | Count of all emergency department visits | total_ed_visits | Number |
| ili_pne_visits | Count of influenza-like illness and/or pneumonia visits | ili_pne_visits | Number |
| ili_pne_admissions | Count of influenza-like illness and/or pnuemonia visits admitted to the hospital | ili_pne_admissions | Number |

# Credibility

CENTRALNA KOMISJA EGZAMINACYJNA

## Wyniki egzaminu maturalnego w 2024 roku

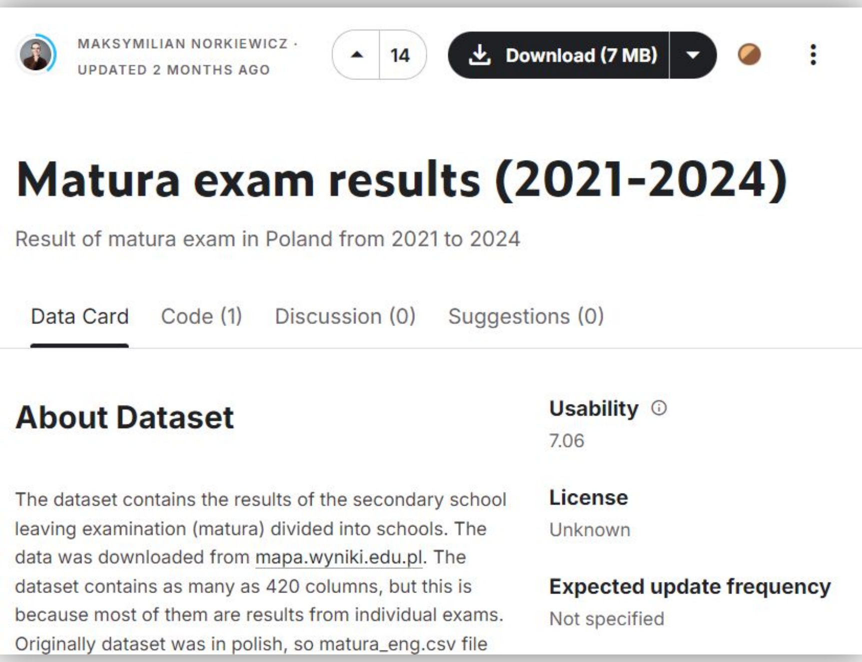
- Wstępne informacje o wynikach egzaminu maturalnego 2024
- Wstępne informacje o wynikach egzaminu maturalnego 2024_CENTYLE
- Wstępne informacje o wynikach egzaminu maturalnego 2024_STANINY POL
- Wstępne informacje o wynikach egzaminu maturalnego 2024_STANINY ENG
- Wyniki egzaminu maturalnego 2024 PREZENTACJA
- Mapki z wynikami egzaminu maturalnego

# Credibility


CENTRALNA KOMISJA EGZAMINACYJNA

Wyniki egzaminu maturalnego w 2024 roku

- Wstępne informacje o wynikach egzaminu maturalnego 2024
- Wstępne informacje o wynikach egzaminu maturalnego 2024_CENTYLE
- Wstępne informacje o wynikach egzaminu maturalnego 2024_STANINY POL
- Wstępne informacje o wynikach egzaminu maturalnego 2024_STANINY ENG
- Wyniki egzaminu maturalnego 2024 PREZENTACJA
- Mapki z wynikami egzaminu maturalnego


MAKSYMILIAN NORKIEWICZ · UPDATED 2 MONTHS AGO

14

Download (7 MB)

Matura exam results (2021-2024)

Result of matura exam in Poland from 2021 to 2024

Data Card | Code (1) | Discussion (0) | Suggestions (0)

About Dataset

The dataset contains the results of the secondary school leaving examination (matura) divided into schools. The data was downloaded from mapa.wyniki.edu.pl. The dataset contains as many as 420 columns, but this is because most of them are results from individual exams. Originally dataset was in polish, so matura_eng.csv file

Usability
7.06

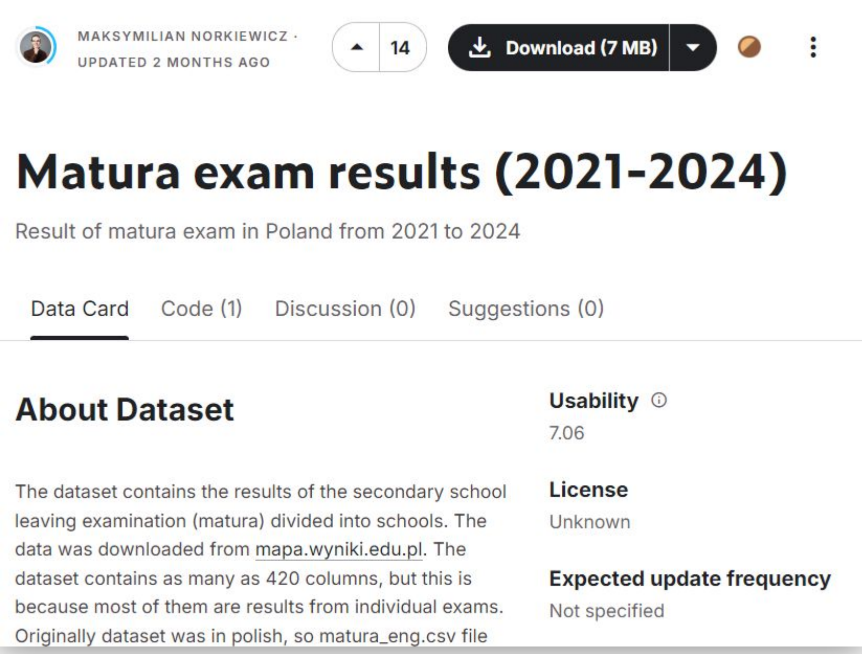
License
Unknown

Expected update frequency
Not specified

# Credibility


## Wyniki egzaminu maturalnego w 2024 roku

- Wstępne informacje o wynikach egzaminu maturalnego 2024
- Wstępne informacje o wynikach egzaminu maturalnego 2024_CENTYLE
- Wstępne informacje o wynikach egzaminu maturalnego 2024_STANINY POL
- Wstępne informacje o wynikach egzaminu maturalnego 2024_STANINY ENG
- Wyniki egzaminu maturalnego 2024 PREZENTACJA
- Mapki z wynikami egzaminu maturalnego



MAKSYMILIAN NORKIEWICZ · UPDATED 2 MONTHS AGO

14 Download (7 MB)

## Matura exam results (2021-2024)

Result of matura exam in Poland from 2021 to 2024

Data Card Code (1) Discussion (0) Suggestions (0)

### About Dataset

The dataset contains the results of the secondary school leaving examination (matura) divided into schools. The data was downloaded from mapa.wyniki.edu.pl. The dataset contains as many as 420 columns, but this is because most of them are results from individual exams. Originally dataset was in polish, so matura_eng.csv file

**Usability**

7.06

**License**

Unknown

**Expected update frequency**

Not specified

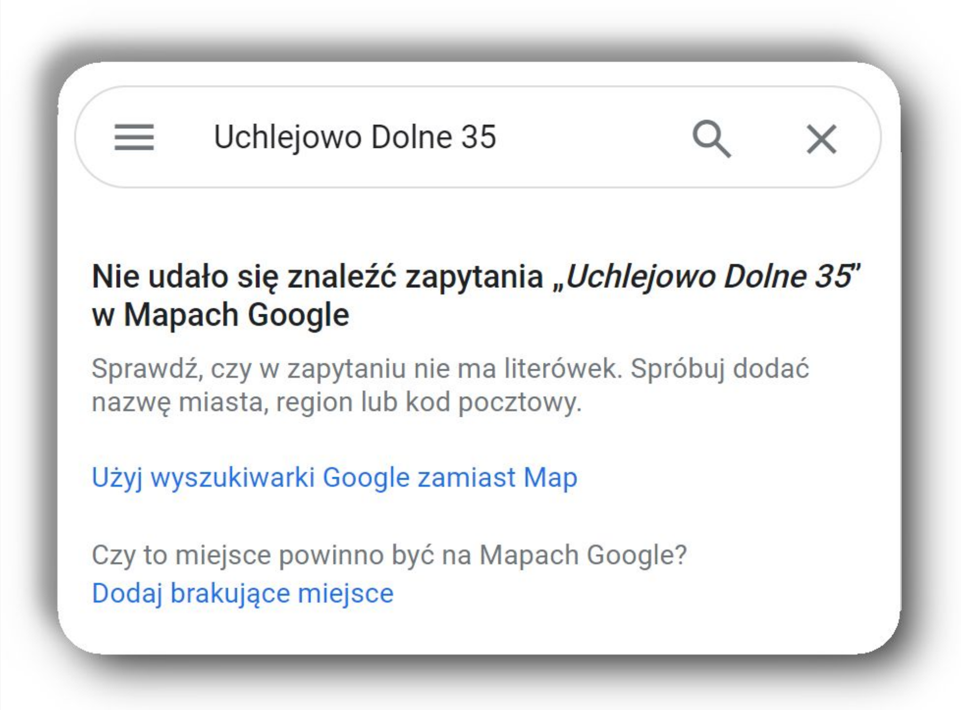
# Reliability

# Accuracy

| | name | surname | address |
|---|---|---|---|
| 0 | Kevin | McCallistera | Uchlejowo Dolne 35 |

# Accuracy

| | name | surname | address |
|---|---|---|---|
| 0 | Kevin | McCallistera | Uchlejowo Dolne 35 |

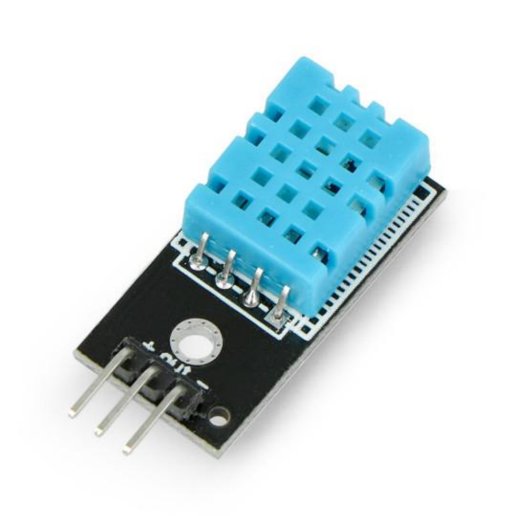


# Accuracy

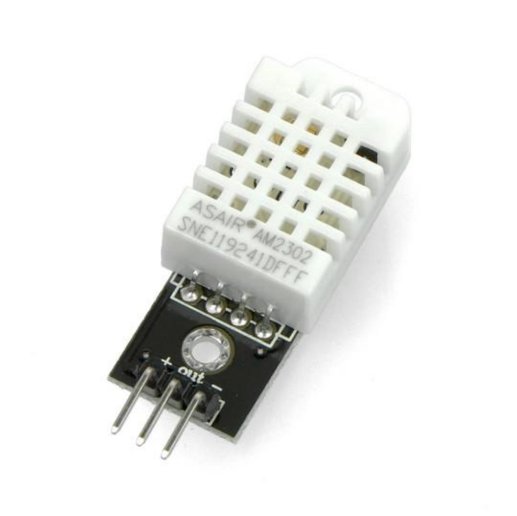
| | name | surname | address |
|---|---|---|---|
| 0 | Kevin | McCallistera | Chicago, IL |

| | name | surname | address |
|---|---|---|---|
| 0 | Kevin | McCallistera | 671 Lincoln Avenue, Chicago, IL 60614 |

# Accuracy



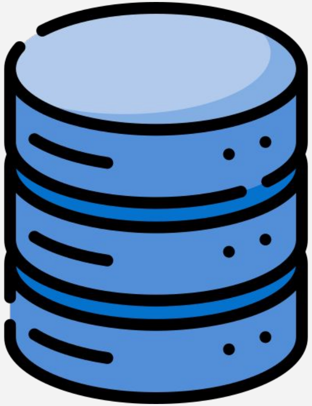
🌡 $\pm 1^\circ\mathrm{C}$




🌡 $\pm 0.5^\circ\mathrm{C}$

# Consistency

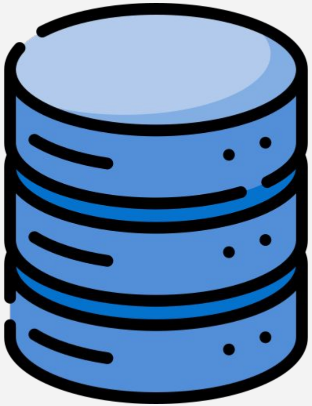
1



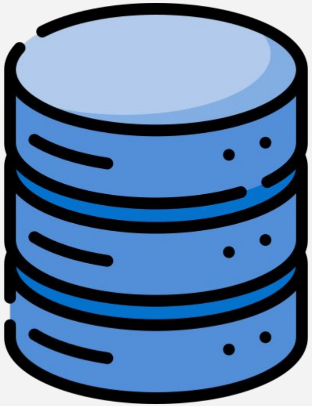
| | name | surname | address |
|---|---|---|---|
| 0 | Kevin | McCallistera | 671 Lincoln Avenue, Chicago |

# Consistency

1



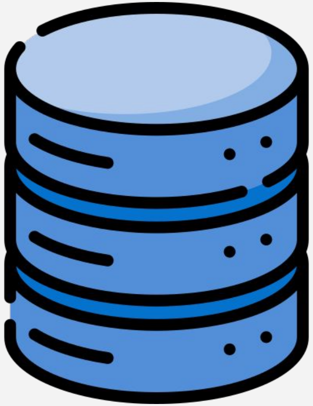
2



| | name | surname | address |
|---|---|---|---|
| 0 | Kevin | McCallistera | 671 Lincoln Avenue, Chicago |

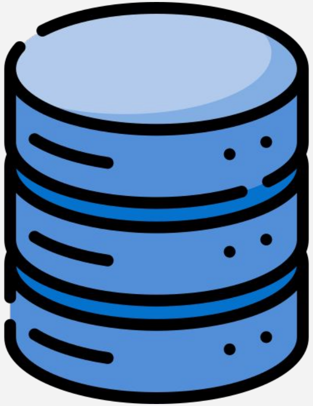
| | name | surname | address |
|---|---|---|---|
| 0 | Kevin | McCallistera | 352 Lincoln Avenue, Chicago |

# Consistency



| | name | surname | age |
|---|---|---|---|
| 0 | Kevin | McCallistera | 13 |

# Consistency



| | name | surname | age | marital_status |
|---|---|---|---|---|
| 0 | Kevin | McCallistera | 13 | divorced |

# Completeness

| | price (PLN) | country | vintage | volume (liters) | kind | medals | wegan | natural | punctation |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 49.0 | Argentyna | 2021.0 | 0.75 | NaN | NaN | False | False | NaN |
| 1 | 75.0 | Węgry | 2019.0 | 0.75 | NaN | NaN | False | False | NaN |
| 2 | 99.0 | Hiszpania | 2018.0 | 0.75 | NaN | NaN | False | True | NaN |
| 3 | 1163.0 | Francja | 2019.0 | 0.75 | NaN | NaN | False | False | NaN |
| 4 | 128.0 | USA | 2018.0 | 0.75 | NaN | NaN | True | False | NaN |

# Presentation Quality

# Readability

| | name | weight | horsepower | model_year | col5 |
|---|---|---|---|---|---|
| 0 | chevrolet chevelle malibu | 3504 | 130.0 | 70 | 18.0 |
| 1 | buick skylark 320 | 3693 | 165.0 | 70 | 15.0 |
| 2 | plymouth satellite | 3436 | 150.0 | 70 | 18.0 |
| 3 | amc rebel sst | 3433 | 150.0 | 70 | 16.0 |
| 4 | ford torino | 3449 | 140.0 | 70 | 17.0 |

# Readability

| | name | weight | horsepower | model_year | fuel_consumption |
|---|---|---|---|---|---|
| 0 | chevrolet chevelle malibu | 3504 | 130.0 | 70 | 18.0 |
| 1 | buick skylark 320 | 3693 | 165.0 | 70 | 15.0 |
| 2 | plymouth satellite | 3436 | 150.0 | 70 | 18.0 |
| 3 | amc rebel sst | 3433 | 150.0 | 70 | 16.0 |
| 4 | ford torino | 3449 | 140.0 | 70 | 17.0 |

# Readability

l/100km (liters per 100km)

MPG (miles per gallon)

| | name | weight | horsepower | model_year | fuel_consumption |
|---|---|---|---|---|---|
| 0 | chevrolet chevelle malibu | 3504 | 130.0 | 70 | 18.0 |
| 1 | buick skylark 320 | 3693 | 165.0 | 70 | 15.0 |
| 2 | plymouth satellite | 3436 | 150.0 | 70 | 18.0 |
| 3 | amc rebel sst | 3433 | 150.0 | 70 | 16.0 |
| 4 | ford torino | 3449 | 140.0 | 70 | 17.0 |

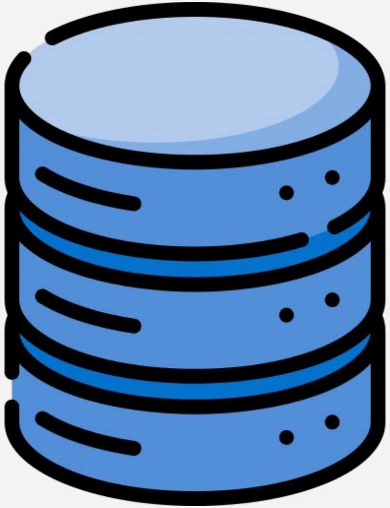
# Structure

## .csv, .tsv

```
"name","surname","email"
"Herminia","Marshall","herminia.marshall@example.com"
"Bernice","Richardson","bernice.richardson@example.com"
"Maeleachlainn","Albertson","maeleachlainn.albertson@example.com"
"Laloecen","Darwin","laloecen.darwin@example.com"
"Shib","Payton","shib.payton@example.com"
"Marcos","Bertolini","marcos.bertolini@example.com"
"Daniël","Teague","daniël.teague@example.com"
"Ikaros","Garber","ikaros.garber@example.com"
"Regulus","Cornell","regulus.cornell@example.com"
"Lars","Simen","lars.simen@example.com"
```

# Structure

## SQL



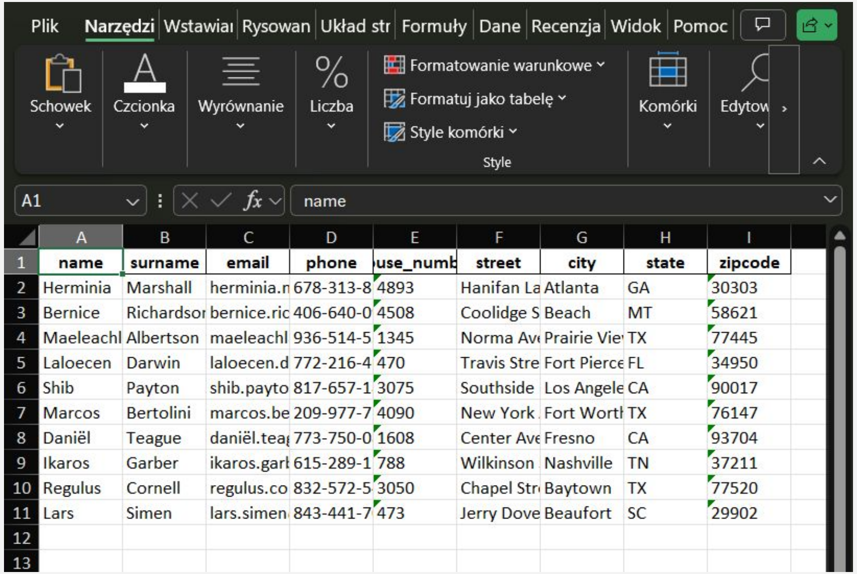
# Structure

## .json


```
{
    "name":{
        "0":"Herminia",
        "1":"Bernice",
        "2":"Maeleachlainn",
        "3":"Laloecen",
        "4":"Shib",
        "5":"Marcos",
        "6":"Dani\u00ebl",
        "7":"Ikaros",
        "8":"Regulus",
        "9":"Lars"
    },
    "surname":{
        "0":"Marshall",
        "1":"Richardson",
        "2":"Albertson",
        "3":"Darwin",
        "4":"Payton",
        "5":"Bertolini",
        "6":"Teague",
```


# Structure

## Excel




| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 1 | name | surname | email | phone | use_numb | street | city | state | zipcode |
| 2 | Herminia | Marshall | herminia.n | 678-313-8 | 4893 | Hanifan La | Atlanta | GA | 30303 |
| 3 | Bernice | Richardsoı | bernice.ric | 406-640-0 | 4508 | Coolidge S | Beach | MT | 58621 |
| 4 | Maeleachl | Albertson | maeleachl | 936-514-5 | 1345 | Norma Av | Prairie Vie | TX | 77445 |
| 5 | Laloecen | Darwin | laloecen.d | 772-216-4 | 470 | Travis Stre | Fort Pierce | FL | 34950 |
| 6 | Shib | Payton | shib.payto | 817-657-1 | 3075 | Southside | Los Angele | CA | 90017 |
| 7 | Marcos | Bertolini | marcos.be | 209-977-7 | 4090 | New York | Fort Wortl | TX | 76147 |
| 8 | Daniël | Teague | daniël.teaį | 773-750-0 | 1608 | Center Ave | Fresno | CA | 93704 |
| 9 | Ikaros | Garber | ikaros.garl | 615-289-1 | 788 | Wilkinson | Nashville | TN | 37211 |
| 10 | Regulus | Cornell | regulus.co | 832-572-5 | 3050 | Chapel Str | Baytown | TX | 77520 |
| 11 | Lars | Simen | lars.simen | 843-441-7 | 473 | Jerry Dove | Beaufort | SC | 29902 |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |

# Structure

| index | feature_1 | feature_2 | feature_3 | feature_4 | feature_5 | feature_6 |
|---|---|---|---|---|---|---|
| 1 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 2 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 3 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 4 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 5 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 6 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 7 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 8 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 9 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 10 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 11 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 12 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 13 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 14 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 15 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 16 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |

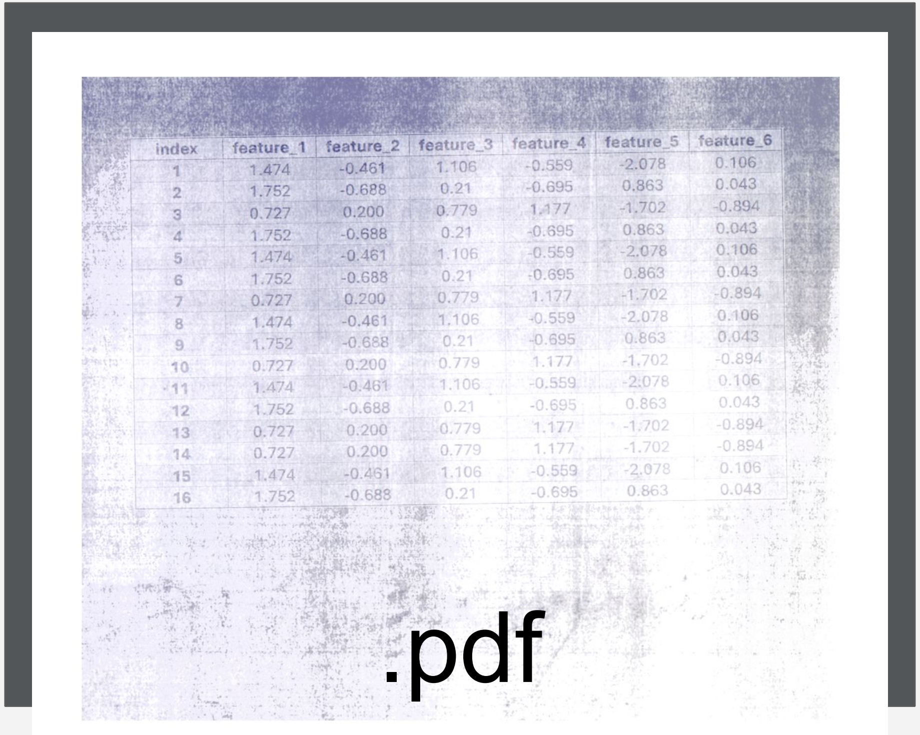
.pdf

# Structure

| index | feature_1 | feature_2 | feature_3 | feature_4 | feature_5 | feature_6 |
|---|---|---|---|---|---|---|
| 1 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 2 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 3 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 4 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 5 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 6 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 7 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 8 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 9 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 10 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 11 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 12 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 13 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 14 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 15 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 16 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |

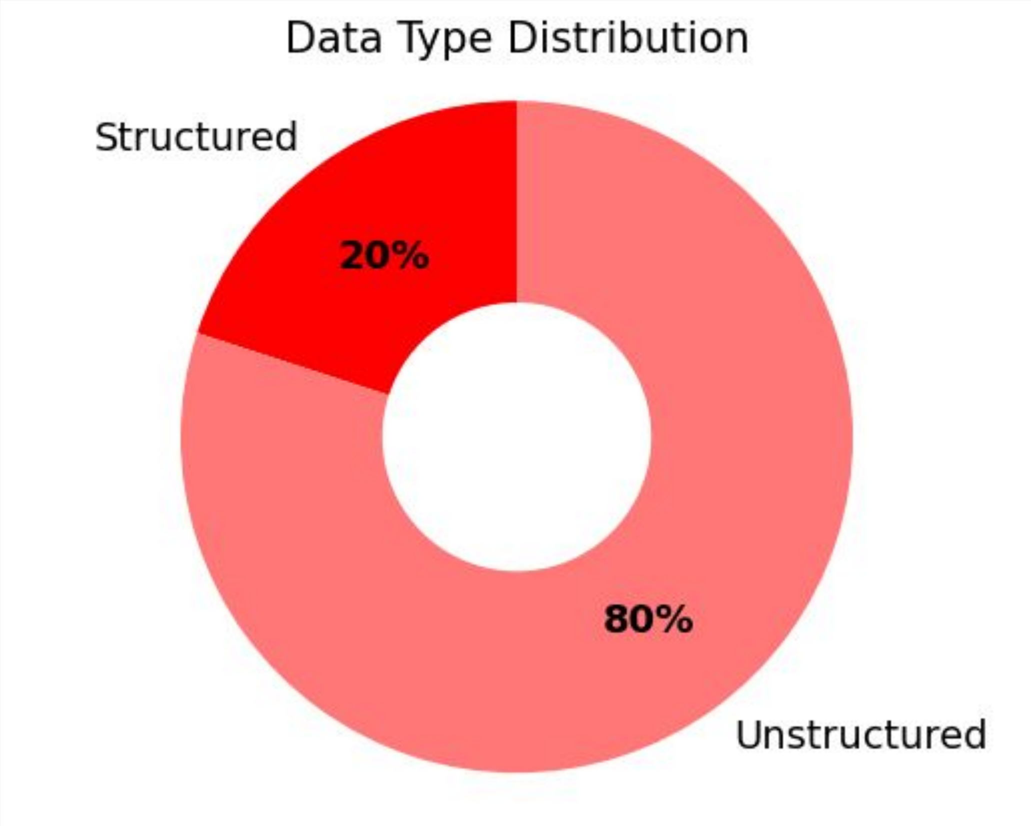
.pdf

# Structure



| index | feature_1 | feature_2 | feature_3 | feature_4 | feature_5 | feature_6 |
|---|---|---|---|---|---|---|
| 1 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 2 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 3 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 4 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 5 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 6 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 7 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 8 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 9 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 10 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 11 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 12 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |
| 13 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 14 | 0.727 | 0.200 | 0.779 | 1.177 | -1.702 | -0.894 |
| 15 | 1.474 | -0.461 | 1.106 | -0.559 | -2.078 | 0.106 |
| 16 | 1.752 | -0.688 | 0.21 | -0.695 | 0.863 | 0.043 |

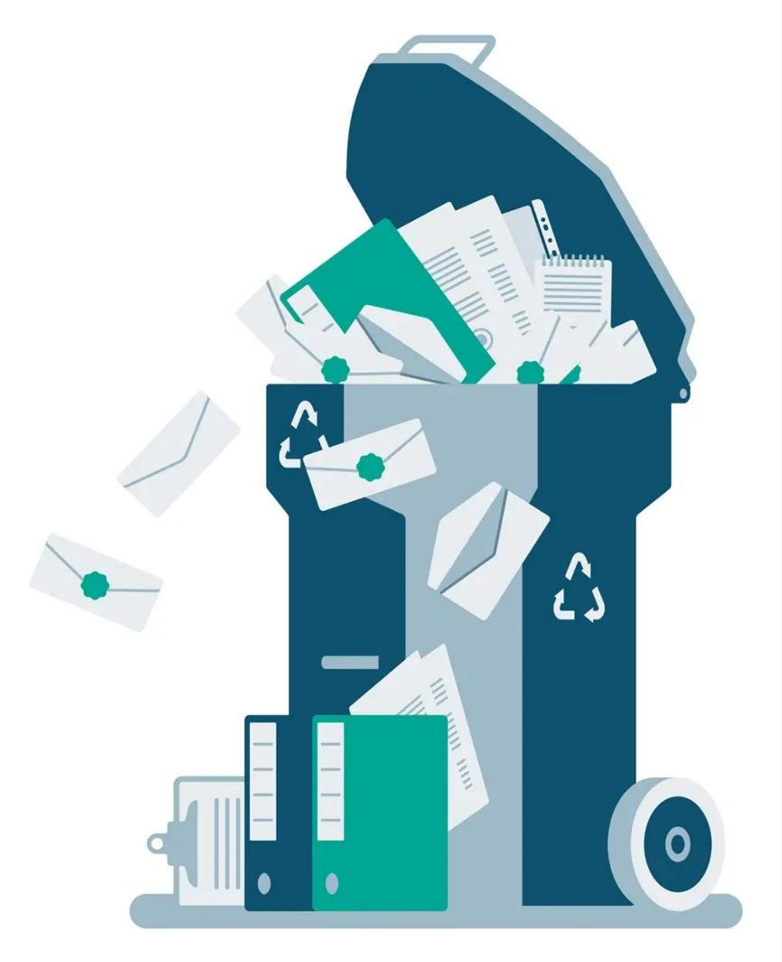



Data Type Distribution
Structured
20%
80%
Unstructured

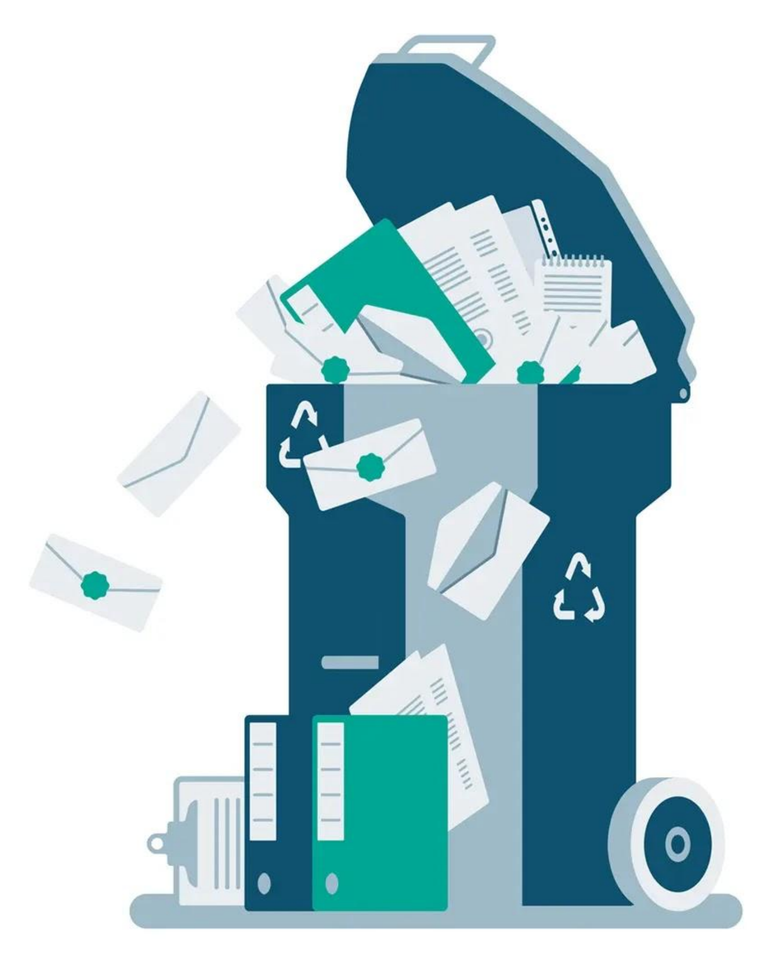
# Data cleaning

# Why data cleaning is important?

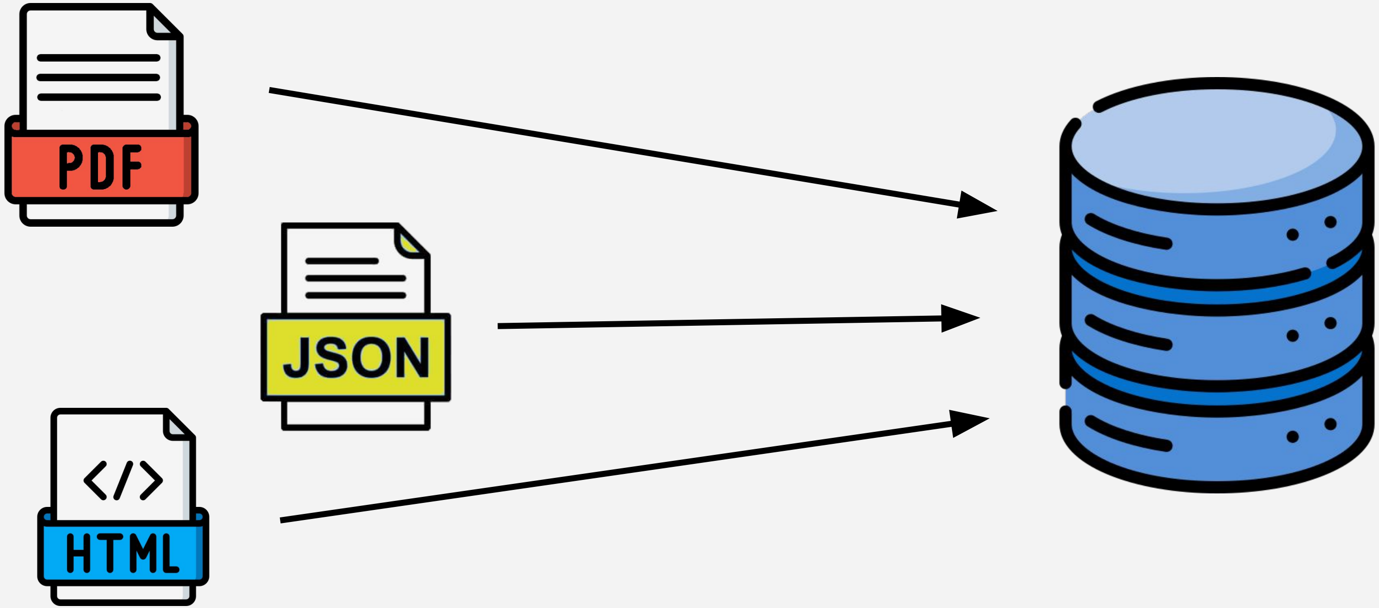
# GIGO



# GARBAGE IN, GARBAGE OUT



# From unstructured data to structured data



# Removing irrelevant data

| | name | weight (lbs) | horsepower | model_year | mpg | link |
|---|---|---|---|---|---|---|
| 0 | toyota corona | 2702 | 96.0 | 75 | 24.0 | https://pl.wikipedia.org/wiki/Toyota_Corona |
| 1 | chevrolet monte carlo s | 4082 | 145.0 | 73 | 15.0 | https://pl.wikipedia.org/wiki/Chevrolet_Monte_... |
| 2 | opel manta | 2158 | 75.0 | 73 | 24.0 | https://pl.wikipedia.org/wiki/Opel_Manta |
| 3 | honda civic 1500 gl | 1850 | NaN | 80 | 44.6 | https://pl.wikipedia.org/wiki/Honda_Civic |
| 4 | chevrolet vega | 2401 | 72.0 | 73 | 21.0 | https://pl.wikipedia.org/wiki/Chevrolet_Vega |
| 5 | chevrolet vega | 2408 | 90.0 | 72 | 20.0 | https://pl.wikipedia.org/wiki/Chevrolet_Vega |

# Removing irrelevant data

| | name | weight (lbs) | horsepower | model_year | mpg |
|---|---|---|---|---|---|
| 0 | toyota corona | 2702 | 96.0 | 75 | 24.0 |
| 1 | chevrolet monte carlo s | 4082 | 145.0 | 73 | 15.0 |
| 2 | opel manta | 2158 | 75.0 | 73 | 24.0 |
| 3 | honda civic 1500 gl | 1850 | NaN | 80 | 44.6 |
| 4 | chevrolet vega | 2401 | 72.0 | 73 | 21.0 |
| 5 | chevrolet vega | 2408 | 90.0 | 72 | 20.0 |

# Removing duplicates

| | name | weight (lbs) | horsepower | model_year | mpg |
|---|---|---|---|---|---|
| 0 | toyota corona | 2702 | 96.0 | 75 | 24.0 |
| 1 | chevrolet monte carlo s | 4082 | 145.0 | 73 | 15.0 |
| 2 | opel manta | 2158 | 75.0 | 73 | 24.0 |
| 3 | honda civic 1500 gl | 1850 | NaN | 80 | 44.6 |
| 4 | chevrolet vega | 2401 | 72.0 | 73 | 21.0 |
| 5 | chevrolet vega | 2408 | 90.0 | 72 | 20.0 |

# Removing duplicates

| | name | weight (lbs) | horsepower | model_year | mpg |
|---|---|---|---|---|---|
| 0 | toyota corona | 2702 | 96.0 | 75 | 24.0 |
| 1 | chevrolet monte carlo s | 4082 | 145.0 | 73 | 15.0 |
| 2 | opel manta | 2158 | 75.0 | 73 | 24.0 |
| 3 | honda civic 1500 gl | 1850 | NaN | 80 | 44.6 |
| 4 | chevrolet vega | 2401 | 72.0 | 73 | 21.0 |
| 5 | chevrolet vega | 2408 | 90.0 | 72 | 20.0 |

# Removing duplicates

| | name | weight (lbs) | horsepower | model_year | mpg |
|---|---|---|---|---|---|
| 0 | toyota corona | 2702 | 96.0 | 75 | 24.0 |
| 1 | chevrolet monte carlo s | 4082 | 145.0 | 73 | 15.0 |
| 2 | opel manta | 2158 | 75.0 | 73 | 24.0 |
| 3 | honda civic 1500 gl | 1850 | NaN | 80 | 44.6 |
| 4 | chevrolet vega | 2401 | 72.0 | 73 | 21.0 |

# Type conversions

| | name | weight (lbs) | horsepower | model_year | mpg |
|---|---|---|---|---|---|
| 0 | toyota corona | 2702 | 96.0 | 75 | 24.0 |
| 1 | chevrolet monte carlo s | 4082 | 145.0 | 73 | 15.0 |
| 2 | opel manta | 2158 | 75.0 | 73 | 24.0 |
| 3 | honda civic 1500 gl | 1850 | NaN | 80 | 44.6 |
| 4 | chevrolet vega | 2401 | 72.0 | 73 | 21.0 |

`numpy.int64`

# Type conversions

| | name | weight (lbs) | horsepower | model_year | mpg |
|---|---|---|---|---|---|
| 0 | toyota corona | 2702 | 96.0 | 1975-01-01 | 24.0 |
| 1 | chevrolet monte carlo s | 4082 | 145.0 | 1973-01-01 | 15.0 |
| 2 | opel manta | 2158 | 75.0 | 1973-01-01 | 24.0 |
| 3 | honda civic 1500 gl | 1850 | NaN | 1980-01-01 | 44.6 |
| 4 | chevrolet vega | 2401 | 72.0 | 1973-01-01 | 21.0 |

`pandas._libs.tslibs.timestamps.Timestamp`

# Units conversion

| | name | weight (lbs) | horsepower | model_year | mpg |
|---|---|---|---|---|---|
| 0 | toyota corona | 2702 | 96.0 | 1975-01-01 | 24.0 |
| 1 | chevrolet monte carlo s | 4082 | 145.0 | 1973-01-01 | 15.0 |
| 2 | opel manta | 2158 | 75.0 | 1973-01-01 | 24.0 |
| 3 | honda civic 1500 gl | 1850 | NaN | 1980-01-01 | 44.6 |
| 4 | chevrolet vega | 2401 | 72.0 | 1973-01-01 | 21.0 |

# Units conversion

pounds

mile per gallon

| | name | weight (lbs) | horsepower | model_year | mpg |
|---|---|---|---|---|---|
| 0 | toyota corona | 2702 | 96.0 | 1975-01-01 | 24.0 |
| 1 | chevrolet monte carlo s | 4082 | 145.0 | 1973-01-01 | 15.0 |
| 2 | opel manta | 2158 | 75.0 | 1973-01-01 | 24.0 |
| 3 | honda civic 1500 gl | 1850 | NaN | 1980-01-01 | 44.6 |
| 4 | chevrolet vega | 2401 | 72.0 | 1973-01-01 | 21.0 |

# Units conversion

kilograms

liters per 100 km

| | name | weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|---|---|
| 0 | toyota corona | 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1 | chevrolet monte carlo s | 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 2 | opel manta | 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 3 | honda civic 1500 gl | 839.1 | NaN | 1980-01-01 | 5.27 |
| 4 | chevrolet vega | 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Dealing with missing values

| | name | weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|---|---|
| 0 | toyota corona | 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1 | chevrolet monte carlo s | 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 2 | opel manta | 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 3 | honda civic 1500 gl | 839.1 | NaN | 1980-01-01 | 5.27 |
| 4 | chevrolet vega | 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Dealing with missing values

| | name | weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|---|---|
| 0 | toyota corona | 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1 | chevrolet monte carlo s | 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 2 | opel manta | 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 3 | honda civic 1500 gl | 839.1 | NaN | 1980-01-01 | 5.27 |
| 4 | chevrolet vega | 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Dealing with missing values

Delete

# Dealing with missing values

Delete or Impute

# Deleting rows

| | name | weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|---|---|
| 0 | toyota corona | 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1 | chevrolet monte carlo s | 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 2 | opel manta | 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 3 | honda civic 1500 gl | 839.1 | NaN | 1980-01-01 | 5.27 |
| 4 | chevrolet vega | 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Deleting columns

| | name | weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|---|---|
| 0 | toyota corona | 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1 | chevrolet monte carlo s | 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 2 | opel manta | 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 3 | honda civic 1500 gl | 839.1 | NaN | 1980-01-01 | 5.27 |
| 4 | chevrolet vega | 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Imputing value

| | name | weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|---|---|
| 0 | toyota corona | 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1 | chevrolet monte carlo s | 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 2 | opel manta | 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 3 | honda civic 1500 gl | 839.1 | NaN | 1980-01-01 | 5.27 |
| 4 | chevrolet vega | 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Mean

| | name | weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|---|---|
| 0 | toyota corona | 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1 | chevrolet monte carlo s | 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 2 | opel manta | 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 3 | honda civic 1500 gl | 839.1 | NaN | 1980-01-01 | 5.27 |
| 4 | chevrolet vega | 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Mean

| | name | weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|---|---|
| 0 | toyota corona | 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1 | chevrolet monte carlo s | 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 2 | opel manta | 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 3 | honda civic 1500 gl | 839.1 | NaN | 1980-01-01 | 5.27 |
| 4 | chevrolet vega | 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Mean

| | name | weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|---|---|
| 0 | toyota corona | 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1 | chevrolet monte carlo s | 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 2 | opel manta | 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 3 | honda civic 1500 gl | 839.1 | 97.0 | 1980-01-01 | 5.27 |
| 4 | chevrolet vega | 1089.1 | 72.0 | 1973-01-01 | 11.20 |

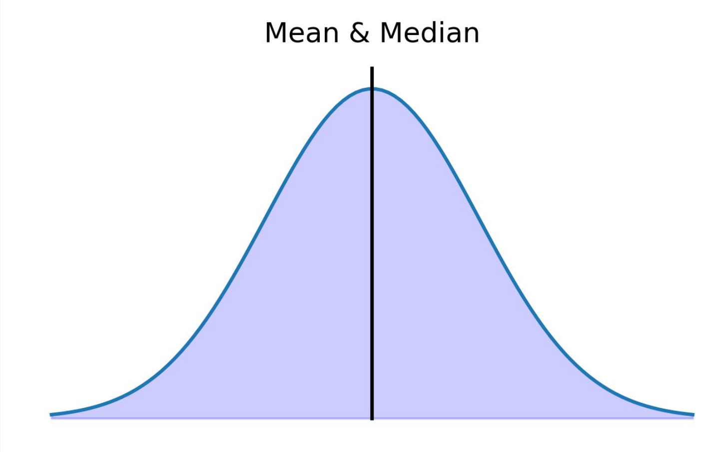
# Median

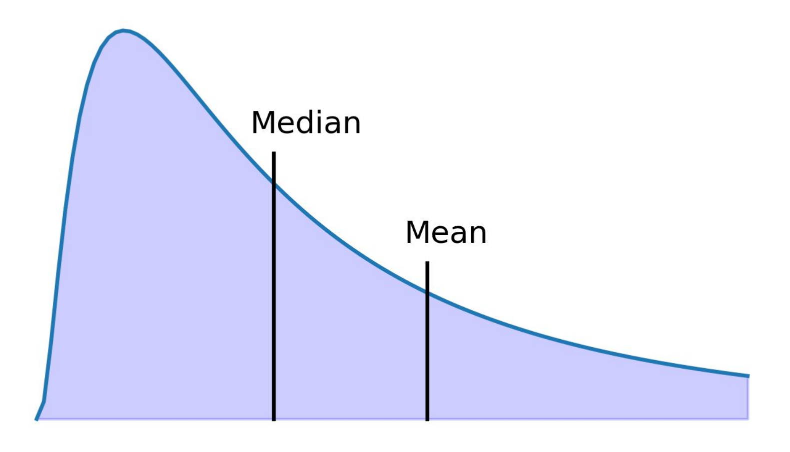
| | name | weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|---|---|
| 0 | toyota corona | 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1 | chevrolet monte carlo s | 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 2 | opel manta | 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 3 | honda civic 1500 gl | 839.1 | NaN | 1980-01-01 | 5.27 |
| 4 | chevrolet vega | 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Median

| | name | weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|---|---|
| 0 | toyota corona | 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1 | chevrolet monte carlo s | 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 2 | opel manta | 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 3 | honda civic 1500 gl | 839.1 | 85.5 | 1980-01-01 | 5.27 |
| 4 | chevrolet vega | 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Mean vs. Median



# Generate random numbers

$\mu = 97$

| horsepower |
|---|
| 96.0 |
| 145.0 |
| 75.0 |
| NaN |
| 72.0 |

# Generate random numbers

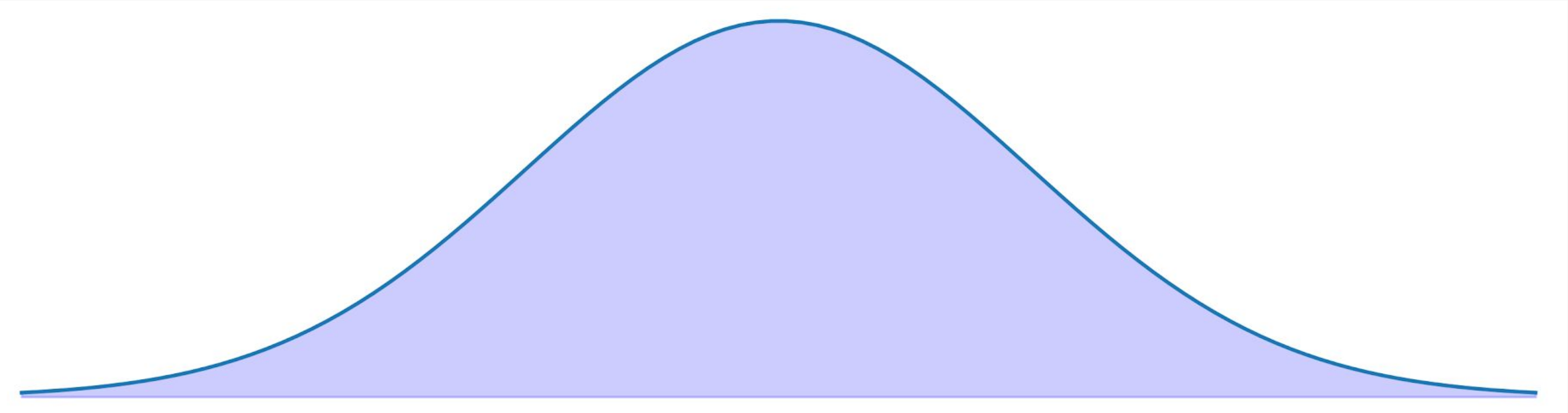
$\mu = 97$

$\sigma = 34$

| horsepower |
|---|
| 96.0 |
| 145.0 |
| 75.0 |
| NaN |
| 72.0 |

# Generate random numbers

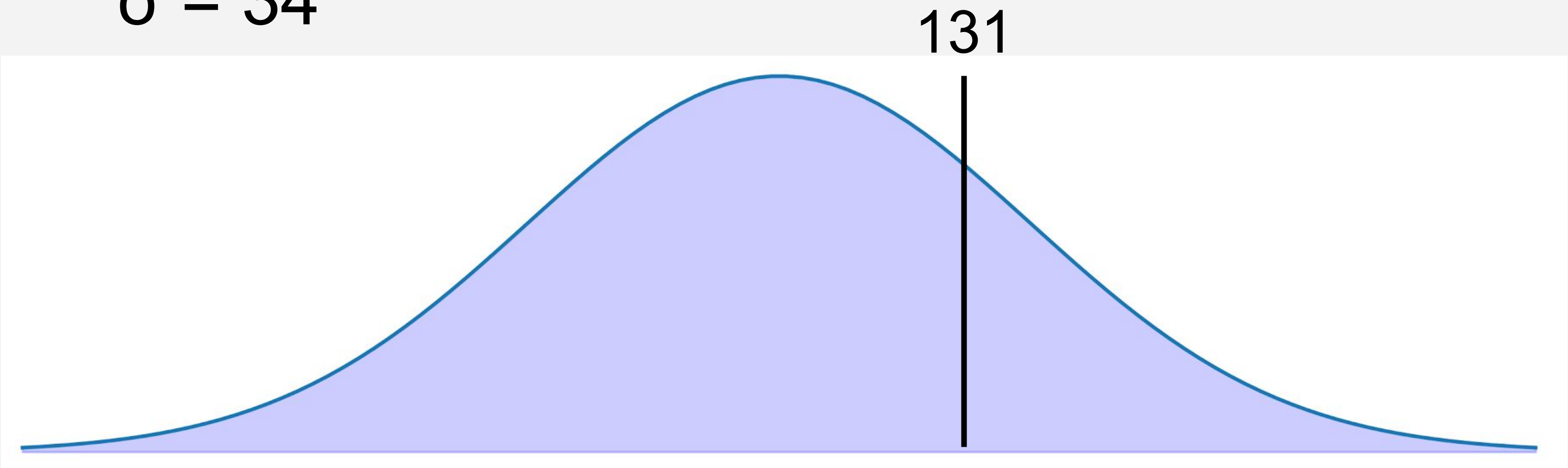
$\mu = 97$
$\sigma = 34$



# Generate random numbers

$\mu = 97$

$\sigma = 34$



# Linear regression

| weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|
| 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 839.1 | NaN | 1980-01-01 | 5.27 |
| 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Linear regression

training features

| weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|
| 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 839.1 | NaN | 1980-01-01 | 5.27 |
| 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Linear regression

training features
training targets

| weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|
| 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 839.1 | NaN | 1980-01-01 | 5.27 |
| 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Linear regression

training features
training targets

features for prediction

| weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|
| 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 839.1 | NaN | 1980-01-01 | 5.27 |
| 1089.1 | 72.0 | 1973-01-01 | 11.20 |

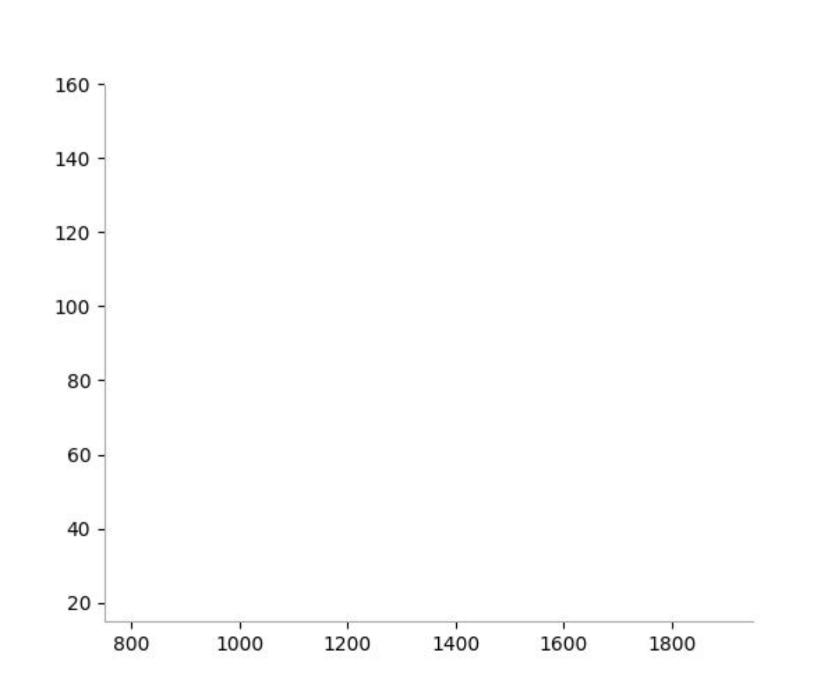
# Linear regression

training features
training targets

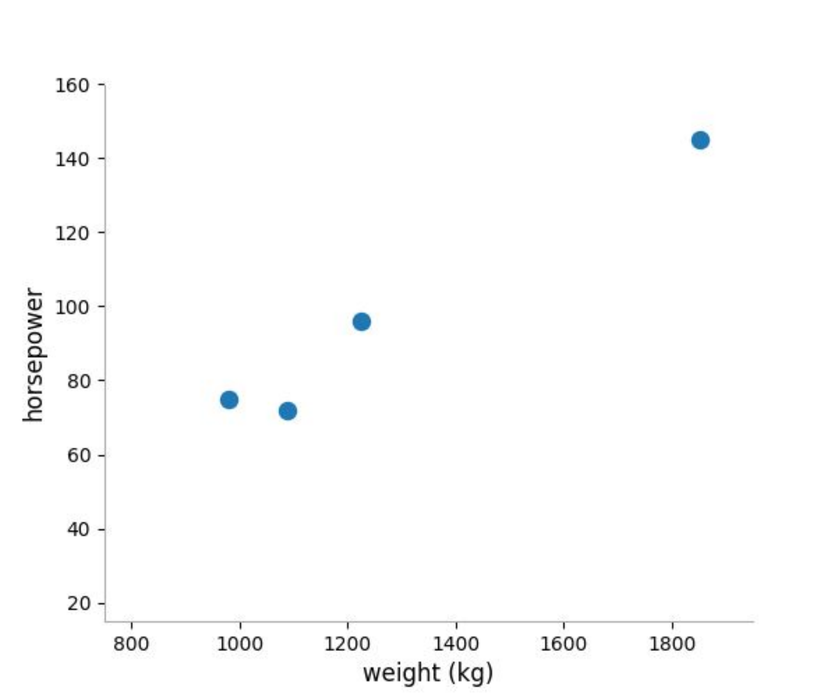
features for prediction
missing values

| weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|
| 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 839.1 | NaN | 1980-01-01 | 5.27 |
| 1089.1 | 72.0 | 1973-01-01 | 11.20 |

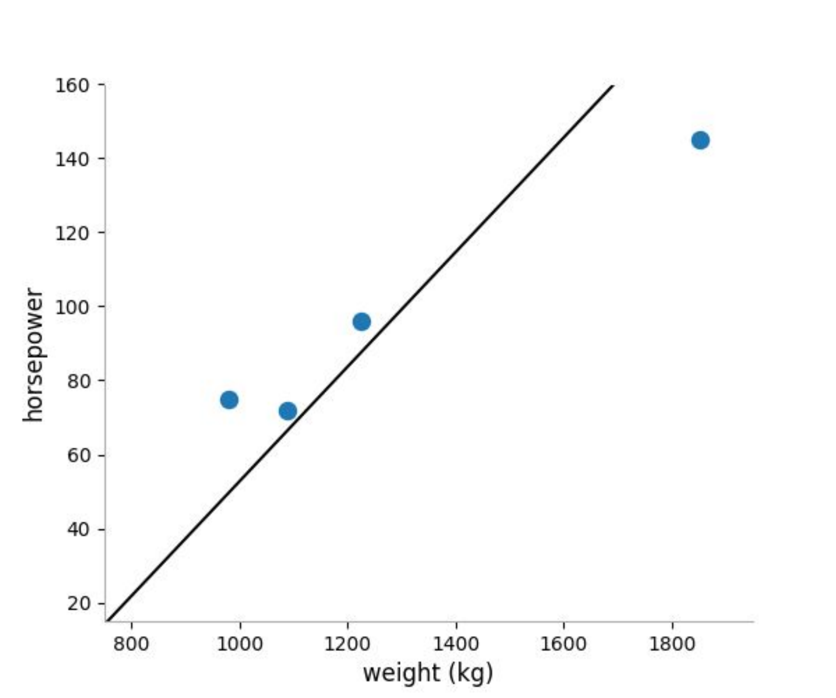
# Linear regression



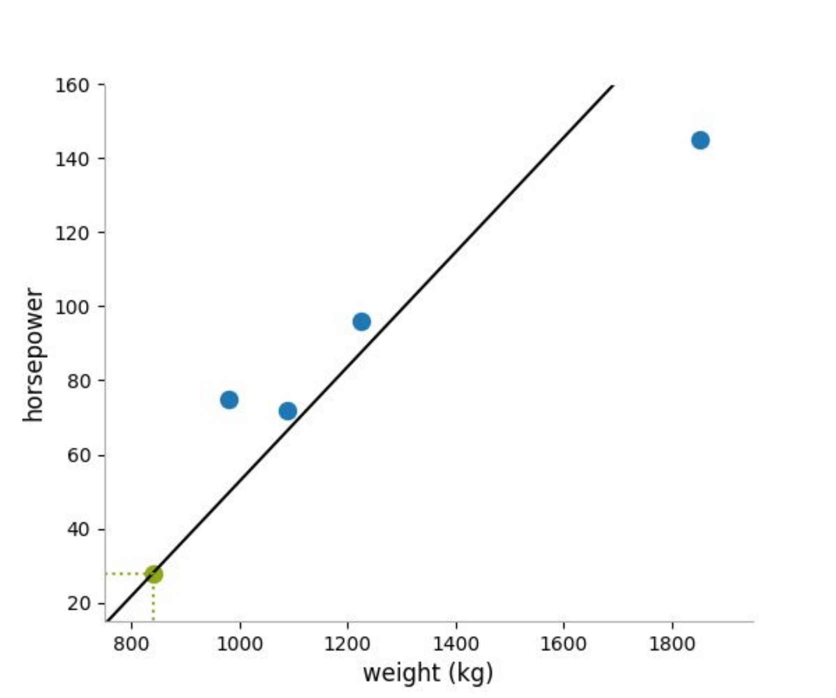
# Linear regression



# Linear regression



# Linear regression



# Linear regression

| | name | weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|---|---|
| 0 | toyota corona | 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1 | chevrolet monte carlo s | 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 2 | opel manta | 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 3 | honda civic 1500 gl | 839.1 | 27.9 | 1980-01-01 | 5.27 |
| 4 | chevrolet vega | 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# Flags

| | name | weight (kg) | horsepower | model_year | l/100km |
|---|---|---|---|---|---|
| 0 | toyota corona | 1225.6 | 96.0 | 1975-01-01 | 9.80 |
| 1 | chevrolet monte carlo s | 1851.6 | 145.0 | 1973-01-01 | 15.68 |
| 2 | opel manta | 978.9 | 75.0 | 1973-01-01 | 9.80 |
| 3 | honda civic 1500 gl | 839.1 | missing | 1980-01-01 | 5.27 |
| 4 | chevrolet vega | 1089.1 | 72.0 | 1973-01-01 | 11.20 |

# References


- https://towardsdatascience.com/the-ultimate-guide-to-data-cleaning-3969843991d4
- https://towardsdatascience.com/an-extensive-guide-to-exploratory-data-analysis-ddd99a03199e
- https://account.datascience.codata.org/index.php/up-j-dsj/article/view/dsj-2015-002
- https://www.sbctc.edu/resources/documents/colleges-staff/commissions-councils/dgc/data-quality-deminsions.pdf
- https://data.cityofnewyork.us/Health/Emergency-Department-Visits-and-Admissions-for-Inf/2nwg-uqyg/about_data
- https://www.cdata.com/blog/structured-vs-unstructured-data