Handling missing data in data science

Simulating the effects of missing data methods and how to present the results in an interactive plot with Github Pages

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Introduction

In this presentation:

1. Missing data methodology

- What is missing data?
- Missing data methods
- Evaluation measures

2. Presentation with Github Pages

- Why?
- How?

Missing data methodology

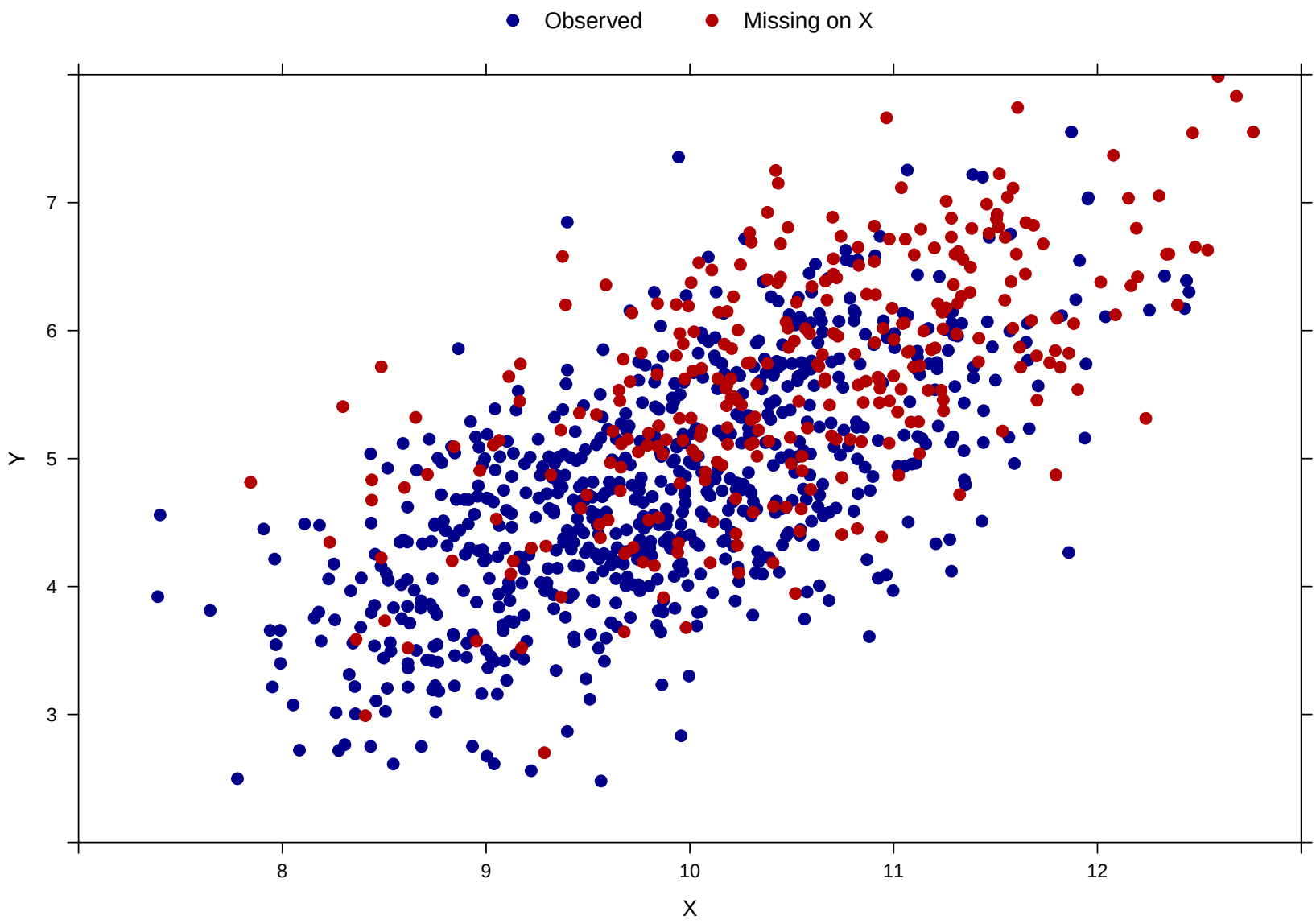
```
head(inc_data)
```

```
##           Y          X
## 1 3.608044 10.880361
## 2 4.959221         NA
## 3 5.284982         NA
## 4 3.415449  9.040452
## 5 5.147952         NA
## 6 5.872563         NA
```

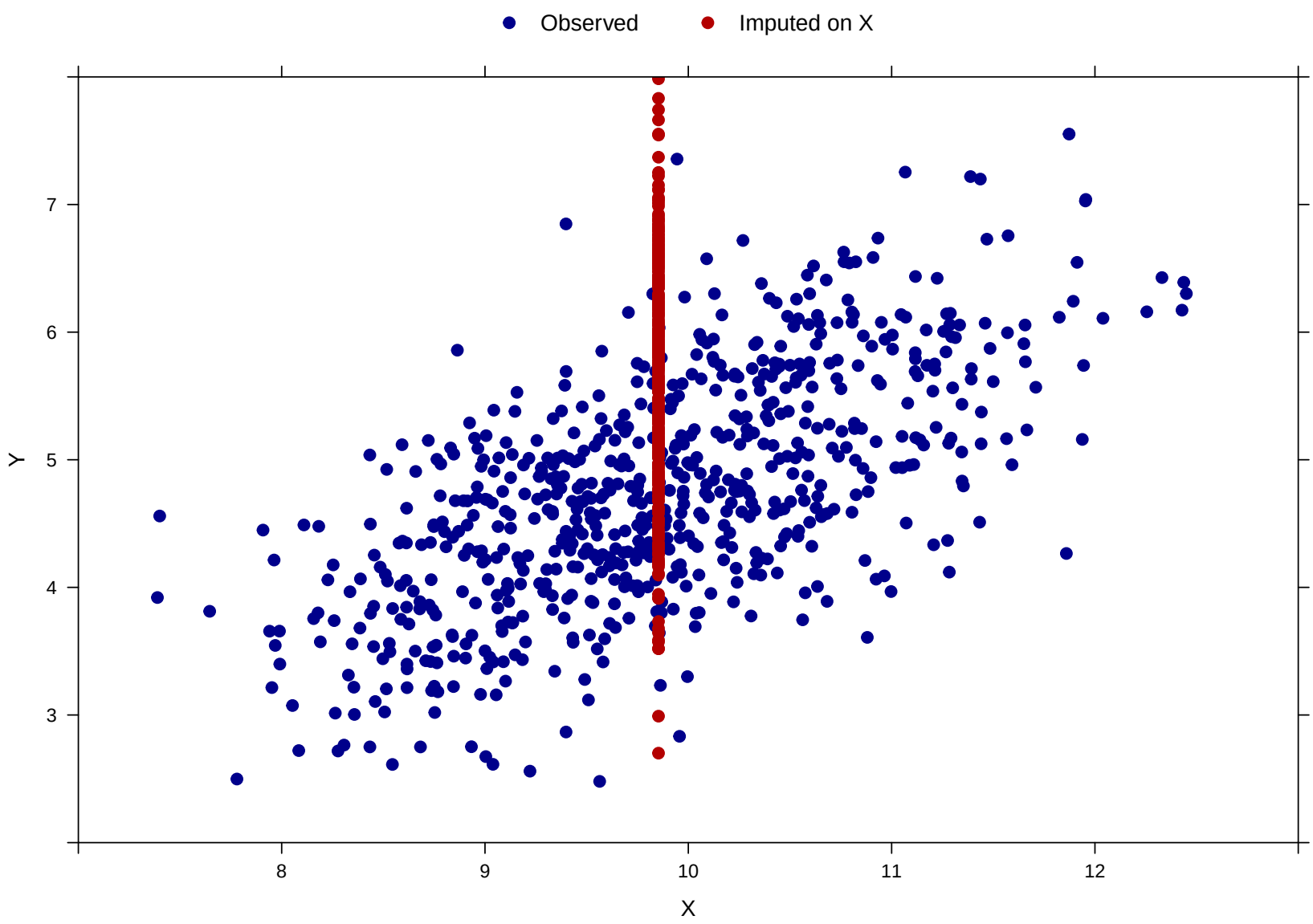
```
require(mice)
md.pattern(inc_data)
```

```
##     Y   X
## 201 1   1   0
## 799 1   0   1
##     0 799 799
```

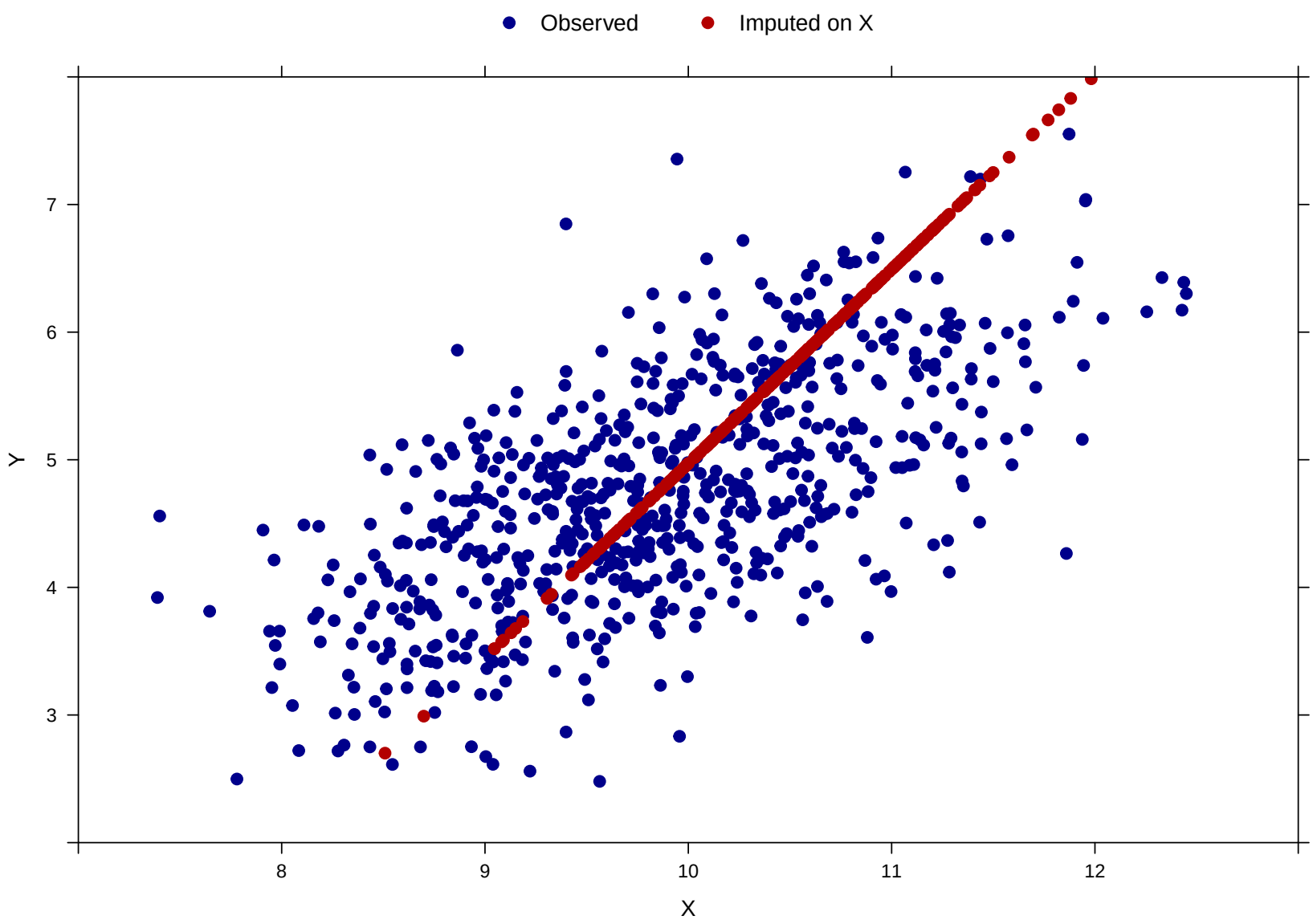
Missing data methodology



Missing data methodology



Missing data methodology



Missing data methodology

1. Drop incomplete rows/columns
2. Imputation

- random imputation
- mean/median imputation
- regression imputation
- random forest imputation
- multiple imputation
- and more...

3. Other methods such as

- weighting procedures
- likelihood based methods
- and more...

Missing data methodology

Simulation study

1. Generate complete data (or use real dataset)
2. Generate missing values in complete data
3. Apply missing data method
4. Perform analysis and compare with complete data

Evaluation measures

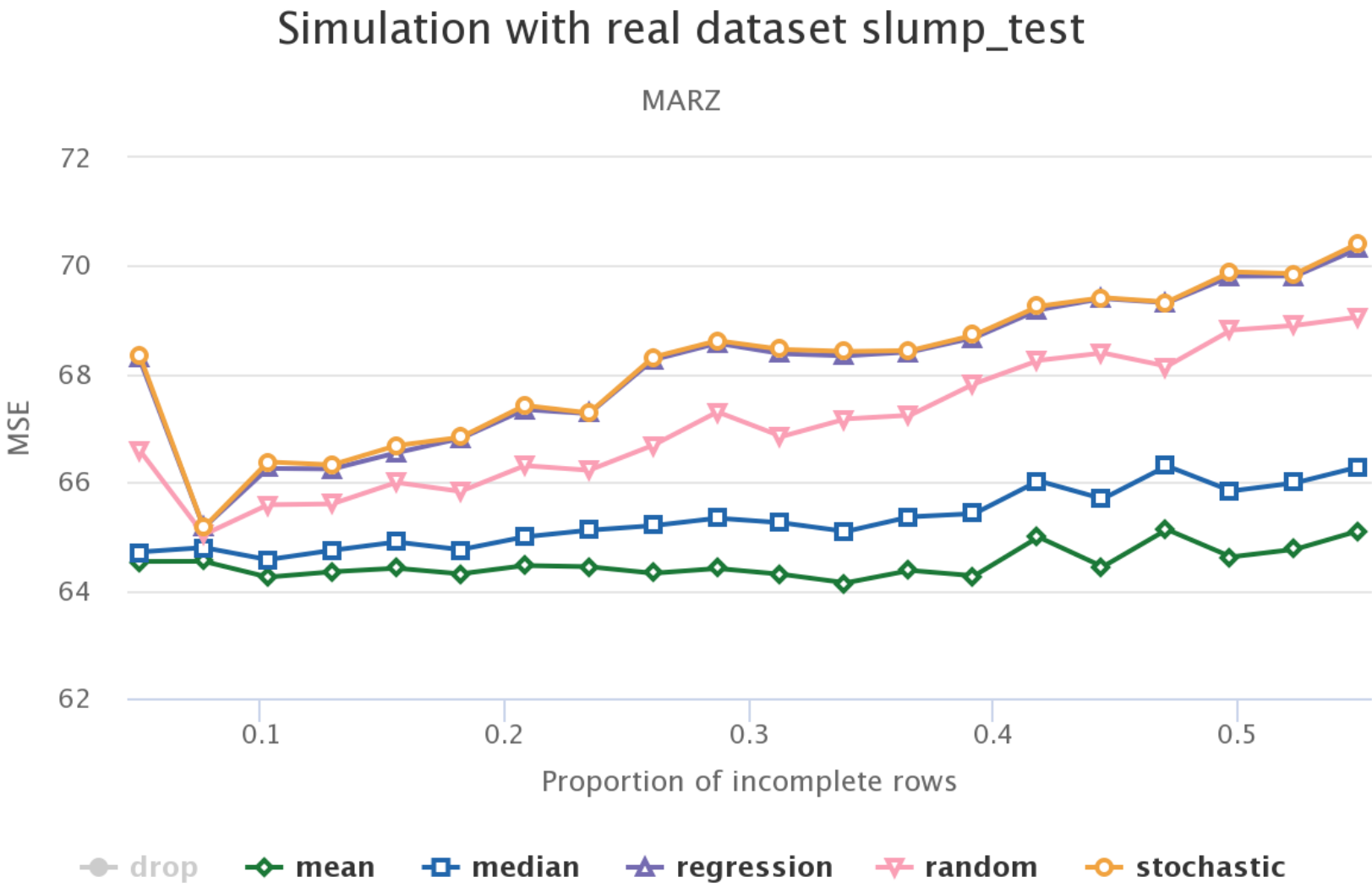
- Statistical validity
- Imputation accuracy
- Prediction accuracy

Github Pages: Why?

Simulation study:

1. Split a given dataset into 60% training data and 40% testset
2. Generate missing values
3. Apply missing data method on the training data.
4. Fit a linear regression model on the completed training data.
5. Apply same missing data method on the test data.
6. Evaluate the performance of the regression model by calculating MSE

Github Pages: Why?



Github Pages: How?

https://rianneschouten.github.io/missing_data_science/

https://github.com/RianneSchouten

https://www.highcharts.com/demo

https://pages.github.com/

https://rianneschouten.github.io

Contact information

Ask me questions or give me feedback:

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Follow my work: rianneschouten.github.io

What are missing data mechanisms?

- MCAR: Missingness is fixed, not related to any variable
- MAR: Missingness is related to an observed variable
- MNAR: Missingness is related to the missingness itself or to an unobserved variable

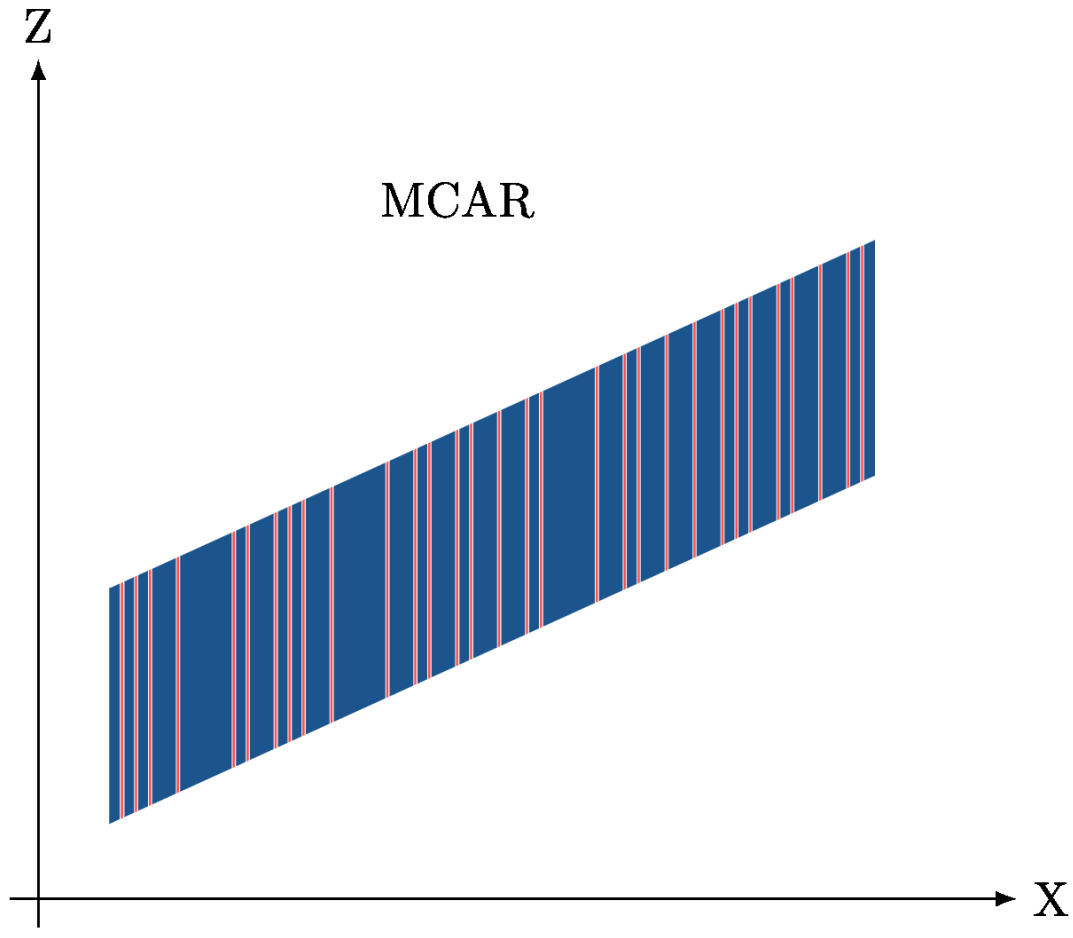
Example:

Consider outcome variable 'income' and feature 'age'

- MCAR: Some age values are missing, both older and younger ages
- MAR: Age values are missing, especially for people with a high income
- MNAR: Age values are missing, especially for older people

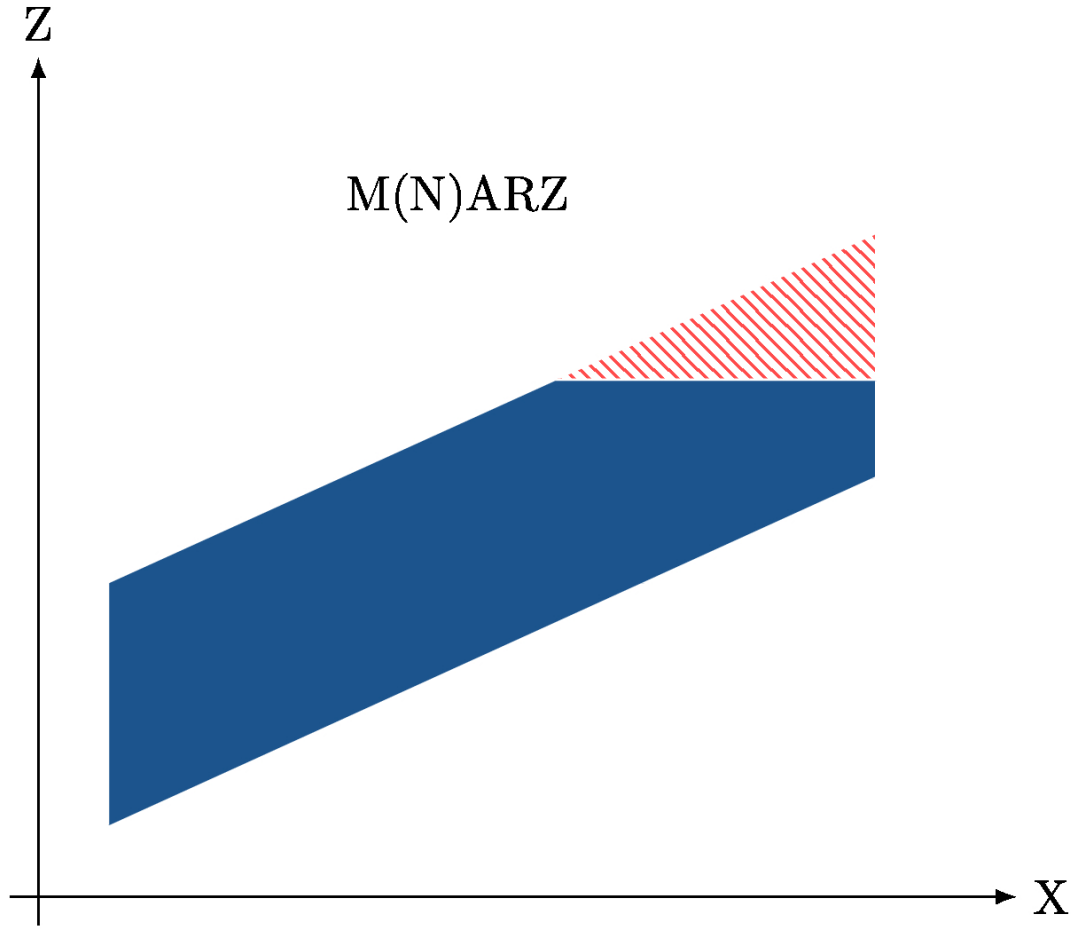
What are missing data mechanisms: MCAR

Independent of value size, values on 'feature X' are missing



What are missing data mechanisms: MAR and MNAR based on Z

Records with a large value on 'Z' are missing on 'feature X'



What are missing data mechanisms: MAR and MNAR based on X

Records with a large value on 'feature X' are missing on 'feature X'