











# Detection of Correlation Reversal Manipulation using Benford's Law and Random Forest

Poj Netsiri, TU Wien Data Science

#### Q: Can we trust this data?

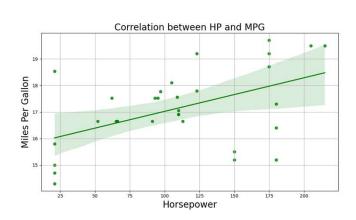
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#### From a given data:

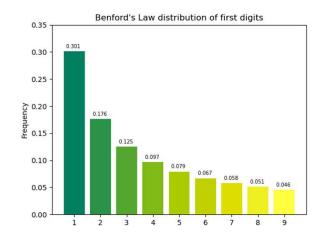
r = 0.5, p = 3.5e-03

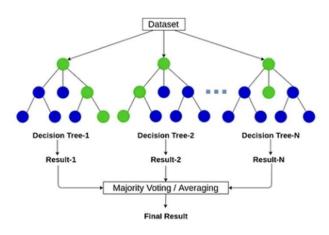
"The more horsepower we have, the more miles per gallon we get."

#### Benford's Law (Statistical Analysis)









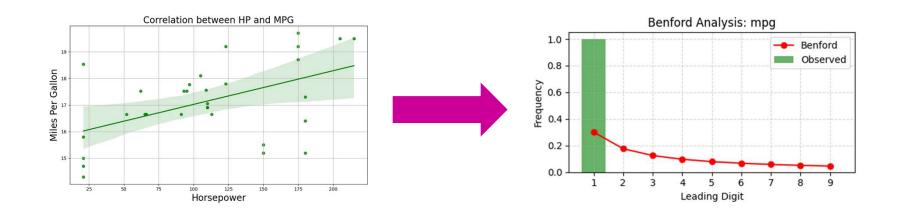
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#### **Using Benford's Law to Detect Manipulation**

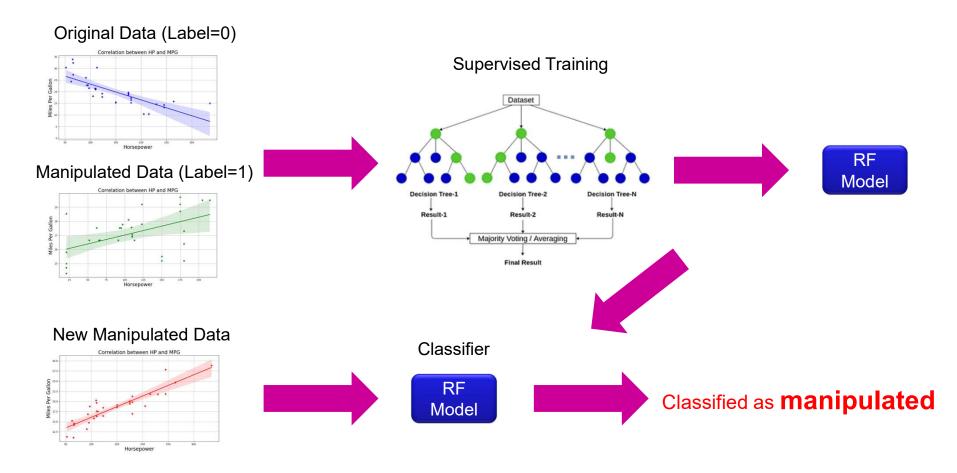


Chi-square = 74.3017, p-value = 0.000000000000

Criteria: Chi-square > 30.58 and p < 0.0001

Classified as **manipulated** (anomaly and extreme)

### **Using Random Forest to Detect Manipulation**

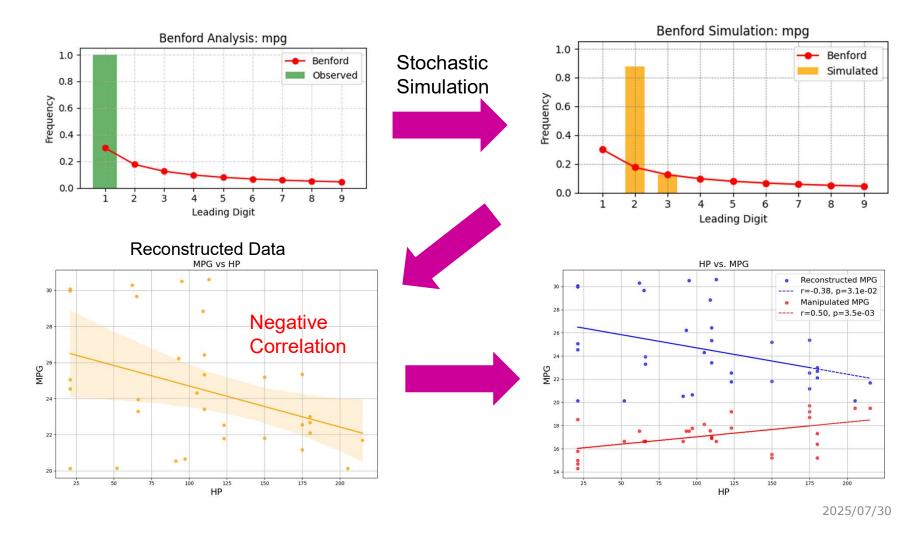




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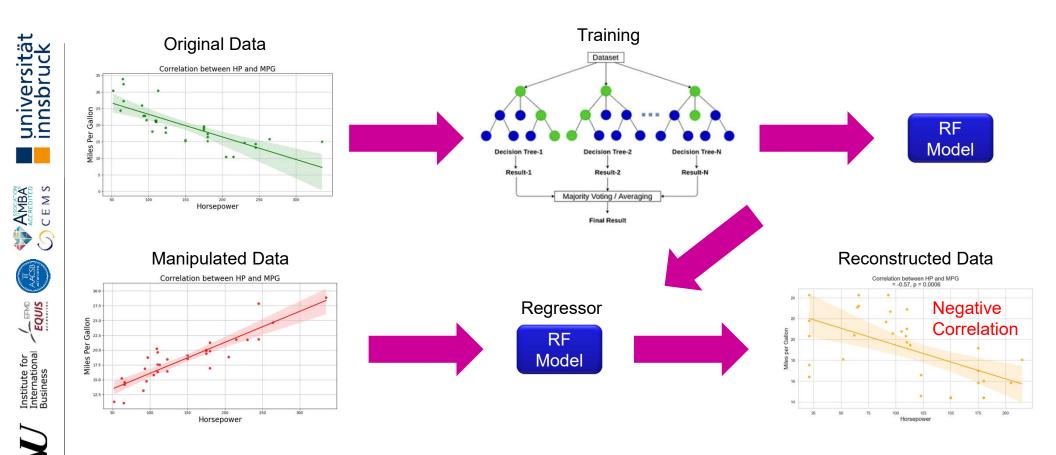
#### Using Benford's Law to Detect Correlation Reversal

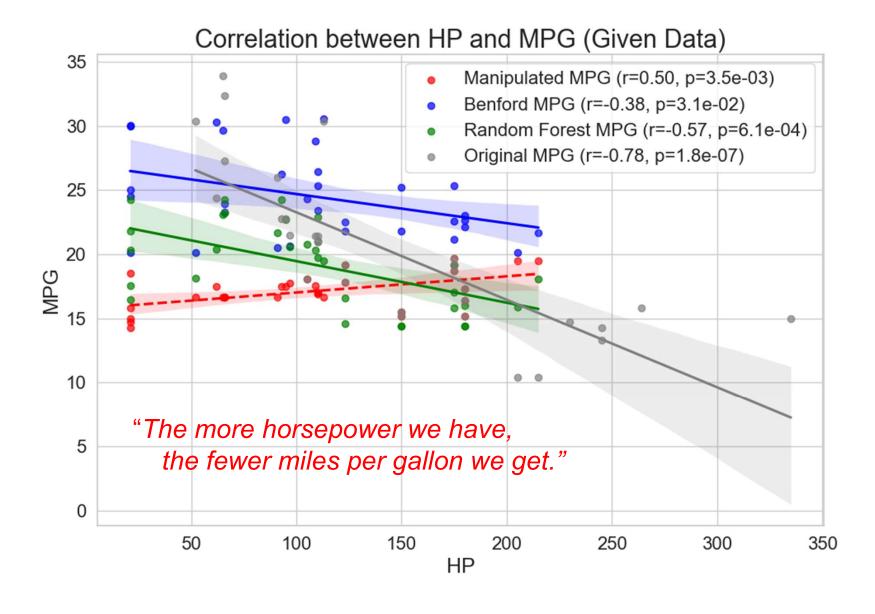


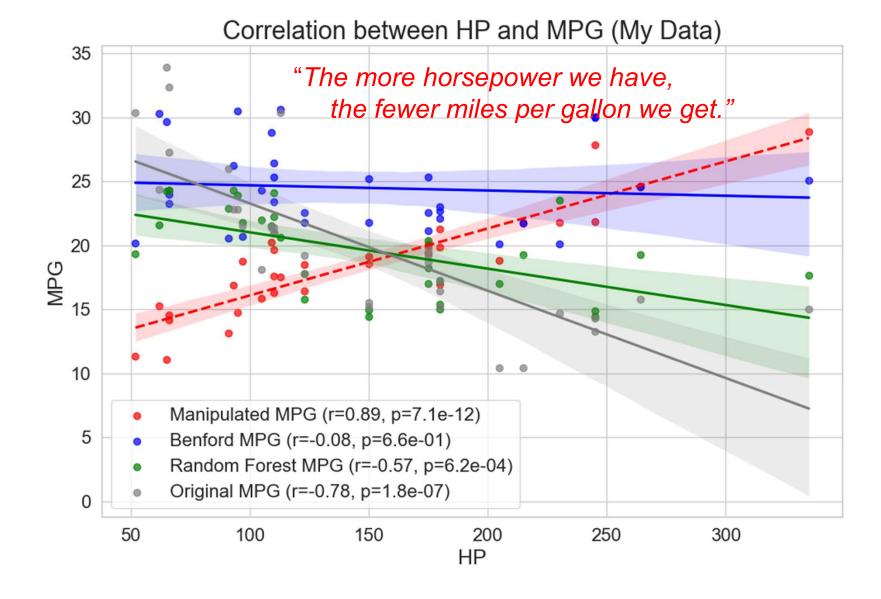
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### **Using Random Forest to Detect Correlation Reversal**







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### 3

#### **Evaluation of Random Forest Classifier and Regressor**

```
=== Random Forest Classification Evaluation ===
    precision recall f1-score support

0 0.83 1.00 0.91 5
1 1.00 0.88 0.93 8
```

=== Random Forest Regression Evaluation ===

R<sup>2</sup> Score : 0.6643

Mean Squared Error: 4.1079

Mean Absolute Error: 1.7576

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#### Conclusion

- 1. Benford's law can detect data manipulation and correlation reversal.
- 2. Random Forest Algorithm can also detect data manipulation and correlation reversal.
- 3. Random Forest could approximate original data better than Benford's law (84% vs. 45%).
- 4. The original data was manipulated to show positive correlation between HP and MPG while still p < 5%.