Data Analytics with Python

Lecture 2

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Causality and Prediction

Content

Statistics

History of Statistics

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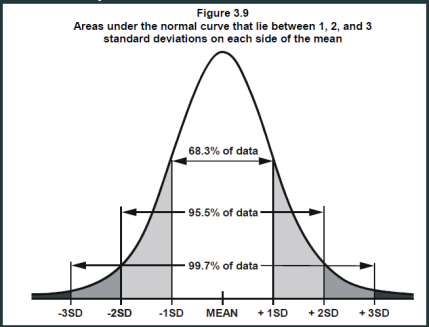
- 1808 Gauss, with contributions from Laplace, derives the normal distribution –the bell-shaped curve fundamental to the study of variation and error.



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- 1958 The Kaplan–Meier estimator gives doctors a simple statistical way of judging which treatments work best. It has saved millions of lives.

Poverty

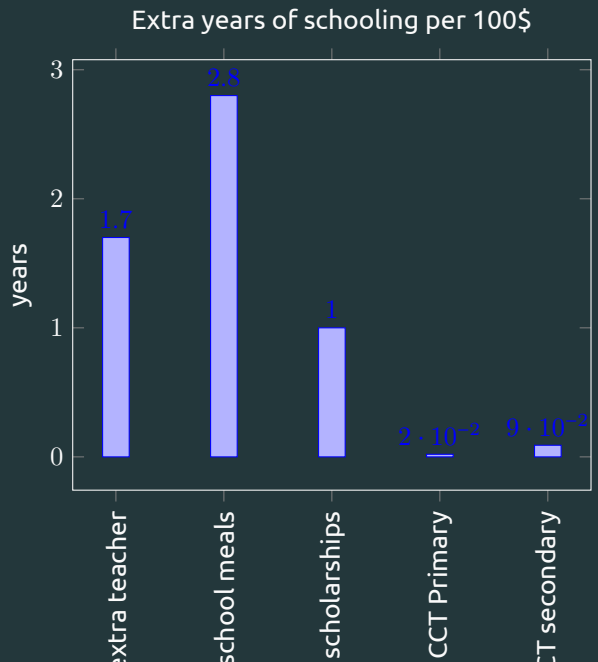
Fighting Poverty

Immunization

- Corruption
- In 2018, about 86% of the world' s children received vaccines that would protect them against polio, diphtheria, tetanus, pertussis, and measles. Immunizations currently prevent 2 million to 3 million deaths every year. Despite this success, more than 1.5million people worldwide die from vaccine-preventable diseases each year.
- Education

Graph are taken from lecture of Esther Duflo [1]

Education


Extra years of schooling per 100$
years
3
2
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1.7
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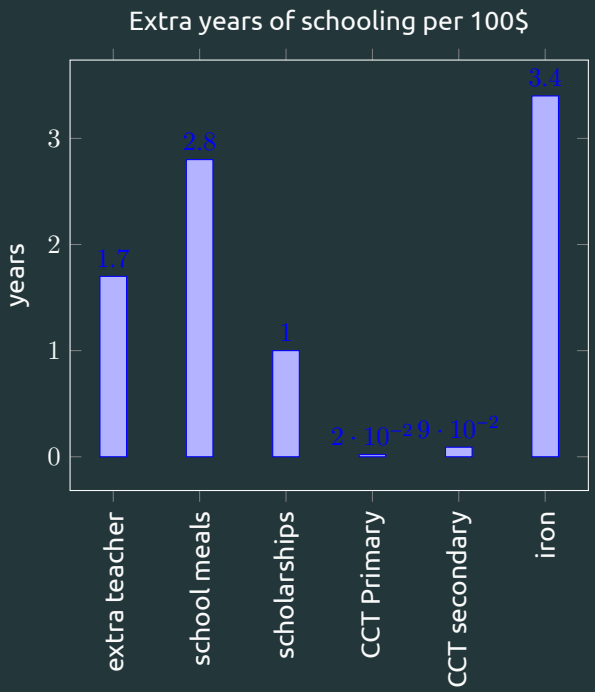
$2 \cdot 10^{-2}$
$9 \cdot 10^{-2}$
xtra teacher
school meals
scholarships
CCT Primary
CT secondary


Extra years of schooling per 100$
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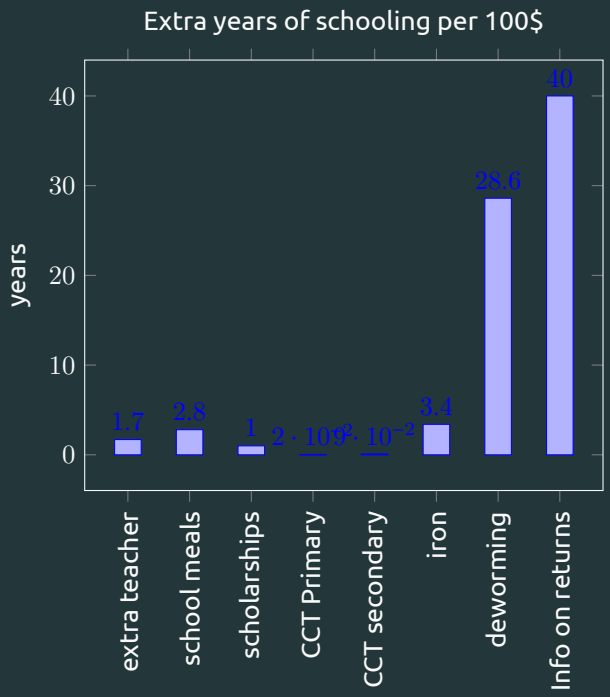
Extra years of schooling per 100$
years
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1.7
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3.4
28.6
40
extra teacher
school meals
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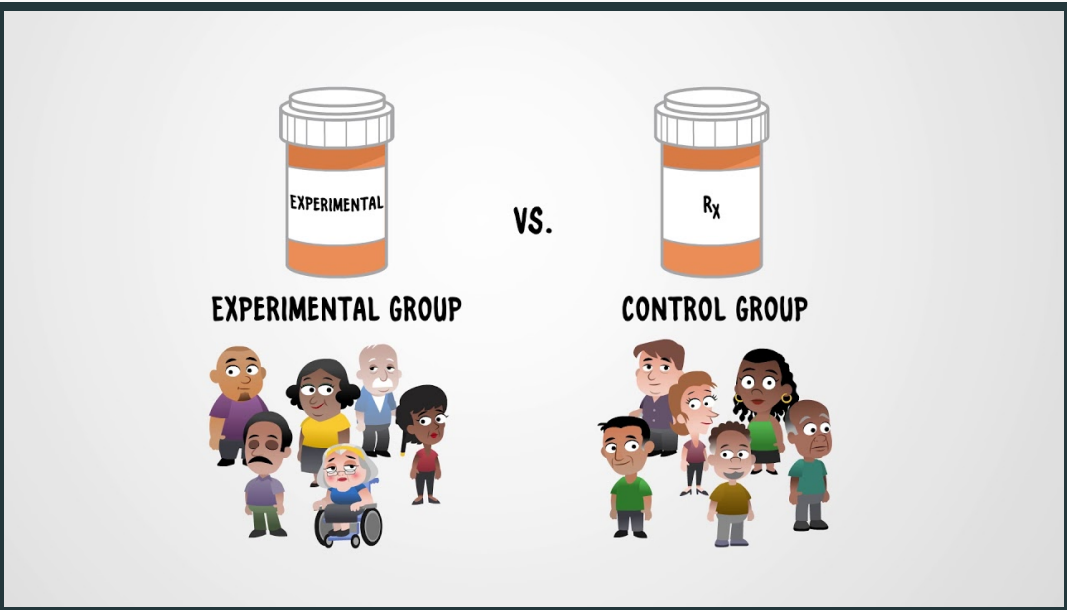
CCT Primary
CCT secondary
iron
deworming
Info on returns

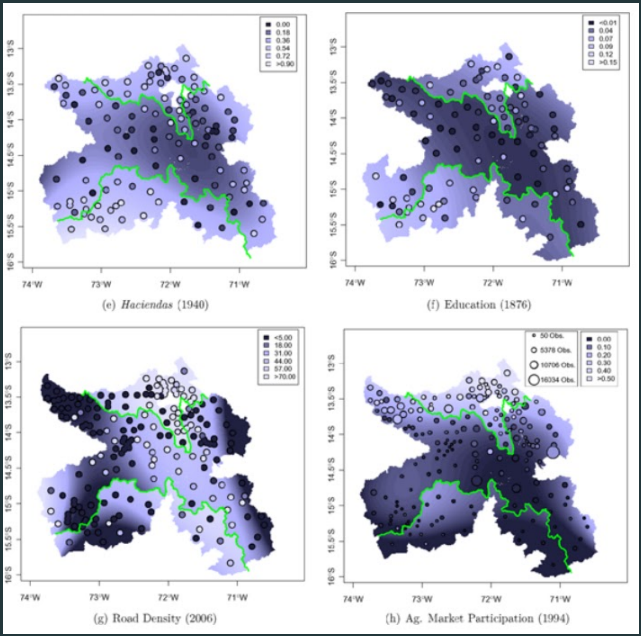
Methods to find causality

- A randomized controlled trial (or RCT)
- Statistical Inference

RCT



Statistical inference



(e) *Haciendas* (1940)

(f) Education (1876)

(g) Road Density (2006)

(h) Ag. Market Participation (1994)

Machine Learning

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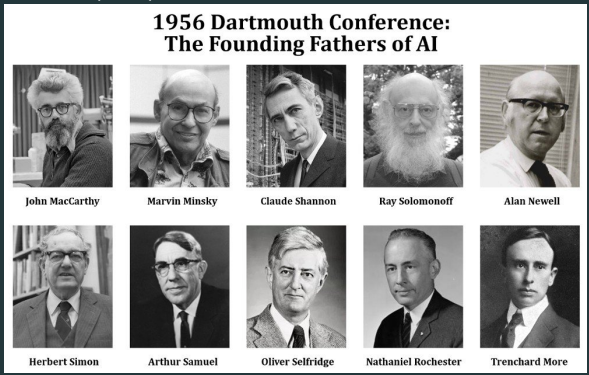

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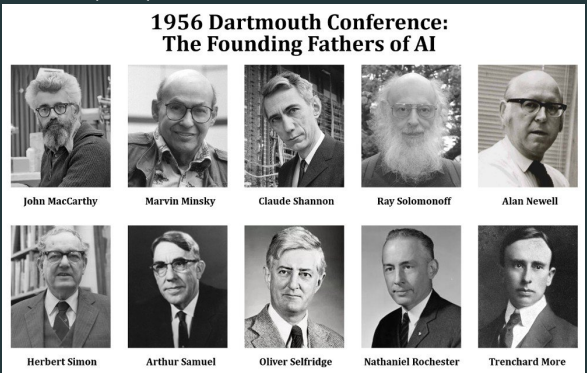

- By 1954 computers were learning checkers strategies and by 1959 were reportedly playing better than the average human, solving word problems in algebra, proving logical theorems.

Initial success

> ”Machines will be capable, within twenty years, of doing any work a man can do”.
>
> —-Herbert Simon(1965)

> ”within a generation ... the problem of creating ’artificial intelligence’ will substantially be solved”
>
> ——Marvin Minsky(1967)

Computer vision

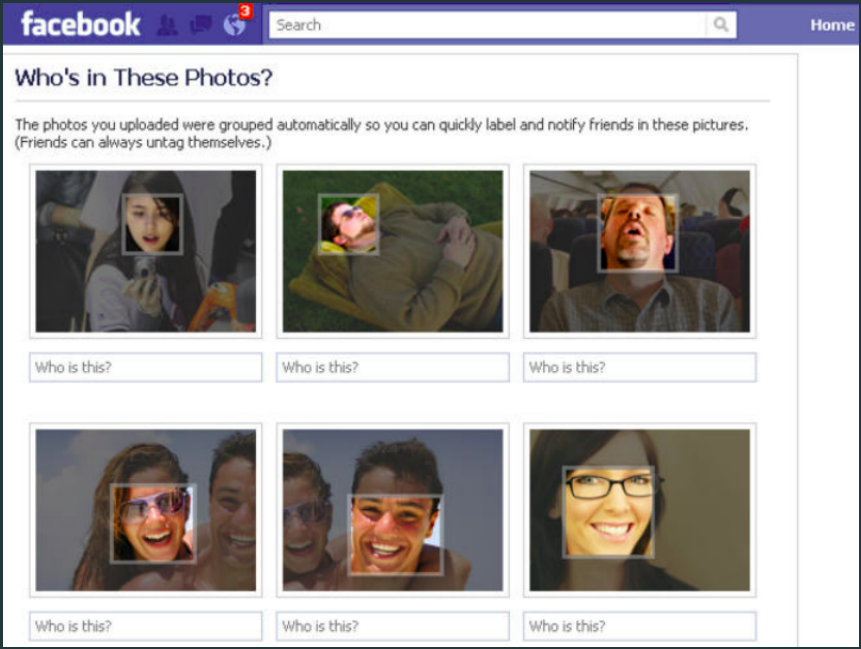

Image Recognition

Sentiment Analysis

Public Policy Applications of Machine Learning

Social Science Applications

- Medicine
- Extracting data(Sattelites, cell Phones)
- Predicting Recidivism
- Isolating violent police officers
- Credit Score
- Building an instrument

Connection between Statistics and Machine Learning

Casuality

1. You want to know structural relationship between x and y, or in other words, you want to find coefficients of function f.

$$y \xleftarrow{f} x$$

$$y = f(x)$$

Prediciton

1. You want to predict y variable, given x variable.

$$y \xleftarrow{f} x$$

$$y = f(x)$$

Statistics(Econometrics)

- Linear Regression
- Logistics Regression
- SVM

Causalty

- Hypothesis testing
- Significant coefficient
- t-statistics

Machine Learning

1. Linear Regression
2. Logistics Regression
3. SVM

Prediction

1. Accuracy
2. R^2
3. Loss function

Thank you for your attention!

Appendix

Materials i

- Esther Duflo.
  Social experiments to fight poverty.
- Sendhil Mullainathan.
  Smarter Algorithms, Better Policy.
  https://www.youtube.com/watch?v=cuGWl3t$_1MI$.