

Statistics: The bridge from maths to the real world

Information for FYSMAT students

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What are the main aims of statistics?

In applied statistics we want to **learn from data**.

Two main aims:

- *Understanding* → drawing conclusions.
- *Predicting* → making informed guesses about the future.

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Third aim:

- Quantify the *uncertainty*.

→ Statistics – and in particular *statistical learning* – plays a key role in many areas of science, finance and industry.

Short movie: [This is statistics](#)

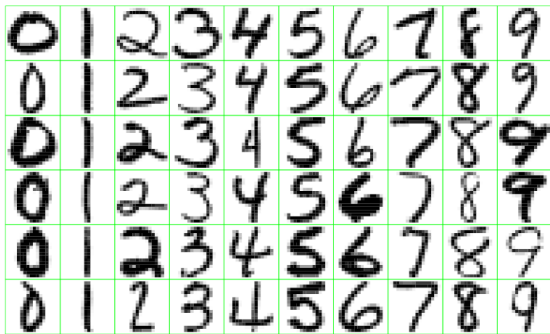
www.thisisstatistics.org

Examples of applied statistical problems

- Epidemiological modeling (covid 19!).
- Stock market prediction.
- Spam detection for emails.
- Identification of the risk factors for certain diseases.
- Effect of medical treatments (clinical studies).
- Weather forecast and climate research.
- Digit recognition.
- Image recognition.
- ... hundreds more!

Example 1: Handwritten digit recognition

- Aim: To identify the numbers in a handwritten ZIP code, from a digitized image.
- **Classification problem**, where the response variable is categorical with classes $\{0, 1, 2, \dots, 9\}$.



Examples of handwritten digits from U.S. postal envelopes.

Image taken from <https://web.stanford.edu/~hastie/ElemStatLearn/>

Example 2: Environmental health factors - the effect of mercury (Hg) on humans

Research question: Is the **Mercury level in the environment** (soil) of people's homes associated to the Mercury levels in their bodies (urin, hair)?

Highly delicate, emotionally charged, political question!

► Swiss TV, 20. June 2016

Wohnzone im Wallis von Quecksilber vergiftet

Vor über vierzig Jahren hatten 3,1 Tonnen Quecksilber einen Abflusskanal nahe der Walliser Gemeinde Visp verschmutzt. Noch heute müssen die Einwohner mit den Folgen leben.



Artikel zum Thema

Konvention gegen Quecksilber verabschiedet

Ein neues internationales Abkommen schränkt die Verwendung von Quecksilber in der Industrie ein. Massgeblich daran beteiligt war die Schweiz. [Mehr...](#)

19.01.2013

Example 3: Evolutionary biology and conservation

Research question: Does inbreeding in Alpine ibex populations have a negative effect on long-term population growth?

Methods: **Genomic data** from blood samples to quantify the level of relatedness and inbreeding in each population.

