Simple and Linear Transformations

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Lecture Outline

- Data transformation
- Linear vs Non-Linear
- Normalisation
- Moving Average
- Sampling
- Discretisation
- Image manipulations

Data Transformation

- Transformations
  - change data
    - Change the numbers
    - Change the way the numbers are arranged
  - Mathematical functions
  - Non-random
  - Can be linear or non-linear
  - Reversible / Non-reversible

Data Transformation

- Reasons for data transformation
  - Reduce data dimensionality
  - Prepare it for further processing
  - Reduce the amount of data to be processed
  - Improve the quality of the data
  - Find similarities between processes
  - Improve understanding of the data

Linear vs Non-Linear

- Linear transformations
  - use a linear function
  - *F(x)* of a raw data vector x such that *F* is a linear function of *x*, e.g. *F(x)=2x+1*
- Non-linear transformations
  - Use a non-linear function
  - F(c) of a raw data vector such that F is a non-linear function of x, e.g. $F(x)=1+e^{x}$
  - Can also be log functions, e.g. *F(x)=1+2log(x)*

Normalisation

- Changes the scale of the data
- Moves from one range to another
- Can be linear or non-linear process
- Can change the distribution of the data
- Linear normalisation
- Changing mean / S.D.

Moving Average

- Time-series data
- Identifies trends
- Smooths a signal
- Passes a moving window over the signal
- Takes the mean of the window
- Shows major changes
- Suppresses noise

Sampling

- Select a subset from the data
- Reduces size of dataset
- Destructive transformation
- Loses data
- Applied to signals
  - Sound
  - Image
  - Time-series data

Discretisation

- Assigns values to bins
- Represents continuous values with intervals
- Reduces size of dataset
- Transformation from interval scale to ordinal scale
  - Reduces information content
  - Destructive transformation

Image Transformations

- Also linear functions
- Several transforms available
  - Resize
  - Rotate
  - Crop
  - Interpolation
- All change the image via some linear function

Summary

- Data transformations have several purposes
- Can be linear or non-linear
- Can be destructive
- Can be applied to most types of data