# Textures

## Visual texture

Main is spatial arrangement of orientation and intensity. Colour comes afterwards

Regularity vs randomness

Uniformity vs distortion

## Properties

Spatial homogeneity: signal statistics of each texture region have similar values

Degree of randomness

* Regular, stochastic

Structural description

* texture consists of elements/primitives organised in a particular spatial structure
  + objects (windows), shapes (jigsaw pieces), or colour patterns

Stochastic description

* a stochastic, possibly periodic, two-dimensional image field
* described by a stochastic process that generates the texture

## Texture analysis and representation

Texture in an image can be perceived at different **scales** or levels of **resolution**

Texture is characterised by the repetition of basic elements also called **textons**

Histograms of textons can give error/uncertainty of distribution of elements

## Statistical approach

First order statistics

* depend only on individual pixel values

Second order statsistics

* depend on the interaction or co-occurrence of neighbouring pixel values
* specified in terms of geometric relationships between pixel pairs

## Edge relates measures

Graphical user interface, text, application

Description automatically generated

**Co-occurrence matrix (Gray-Level Co-occurrence Matrix (GLCM) )**

* The rows and columns represent a set of possible image values
* Cd(i,j) indicates how many times value i co-occurs with value j in a particular spatial relationship d specified by a vector d = (dx,dy)

Text, letter

Description automatically generated

Co-occurrence matrix captures spatial distribution of gray levels.

**Co-occurrence features**

Text

Description automatically generated

Graphical user interface, text, application, email

Description automatically generated

**Autocorrelation function**

* Measures the coarseness of an image

Text, letter

Description automatically generated

Graphical user interface, text

Description automatically generated

Text

Description automatically generated with medium confidence

Diagram

Description automatically generated

## Transform-based approaches texture analysis

* Represent an image in a space whose co-ordinate system interpretation (such as frequency or size) will be closely related to the characteristics of its texture

Text, letter

Description automatically generated

Diagram

Description automatically generated

Frequency detection

Fourier, wavelets