# Project assignment: Part 2

## Image segmentation using mixture models

Spatial Statistics and Image Analysis, TMS016

On the homepage you can find the file `permeability.mat`, which contains permeability measurements from a geological model of a black oil reservoir (see http://www.spe.org/web/csp/). The original data set consists of three-dimensional porosity and permeability data, but we only look at one horizontal slice of the permeability data here.

To simulate flow through a material like this, it may be of interest to find the channels in the material by segmenting the image into the high and low-permeability areas.

1. Test segmenting the image into two classes using

   - the K-means algorithm,
   - a Gaussian mixture model, and
   - a Markov random field mixture model.

   Plot the data and the respective segmentations.

Since this data set is simulated, there is no noise in it. However, one might expect real measurements of permeability to be much more noisy. Generate a "measured" data set by adding independent mean-zero Gaussian noise, with standard deviation $\sigma$, to each pixel in the image.

2. Test segmenting the noisy image into two classes using the K-means algorithm, a Gaussian mixture model, and a Markov random field mixture model as in the first task. Plot the data and the respective segmentations. Try a few different values of $\sigma$ (say 1 and 3), and investigate how sensitive the three methods of segmenting the image are to the noise level.