Segmentation and Colour Models

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Correlation between luminance and RGB in images of wood

- 1. Constructing the model
  - A collection of randomly positioned points within some samples of wood are chosen.
  - The values of Red, Green and Blue at these points are sampled
  - The luminance Y is calculated at each point

$$Y = 0.30R + 0.59G + 0.11B$$

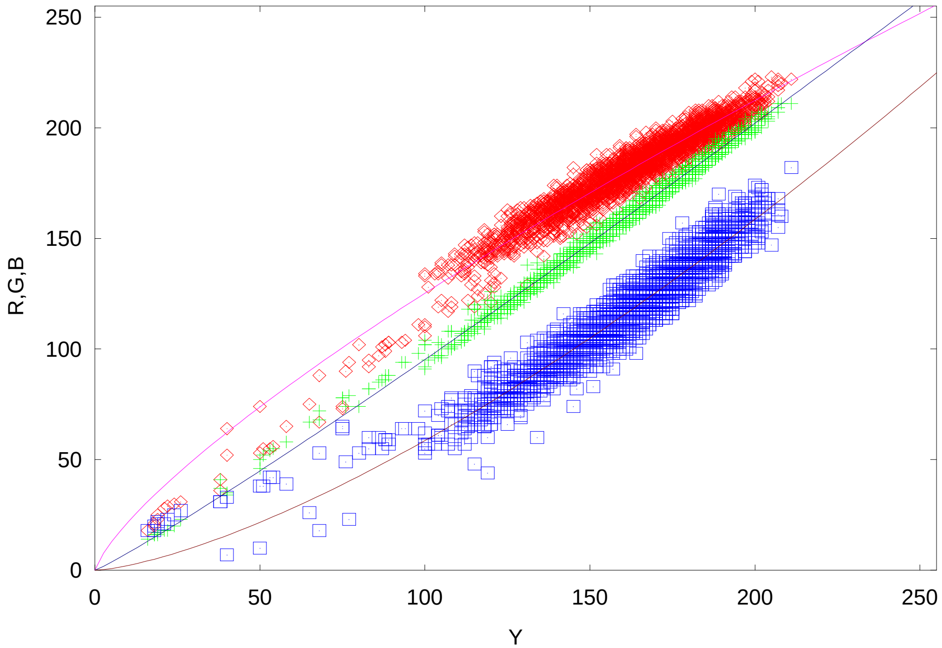
  - Plots of R, G and B versus Y are done
  - Curves of the form given below are fitted to the colours

$$R = a_r Y^{c_r} \qquad G = a_g Y^{c_g} \qquad B = a_b Y^{c_b}$$

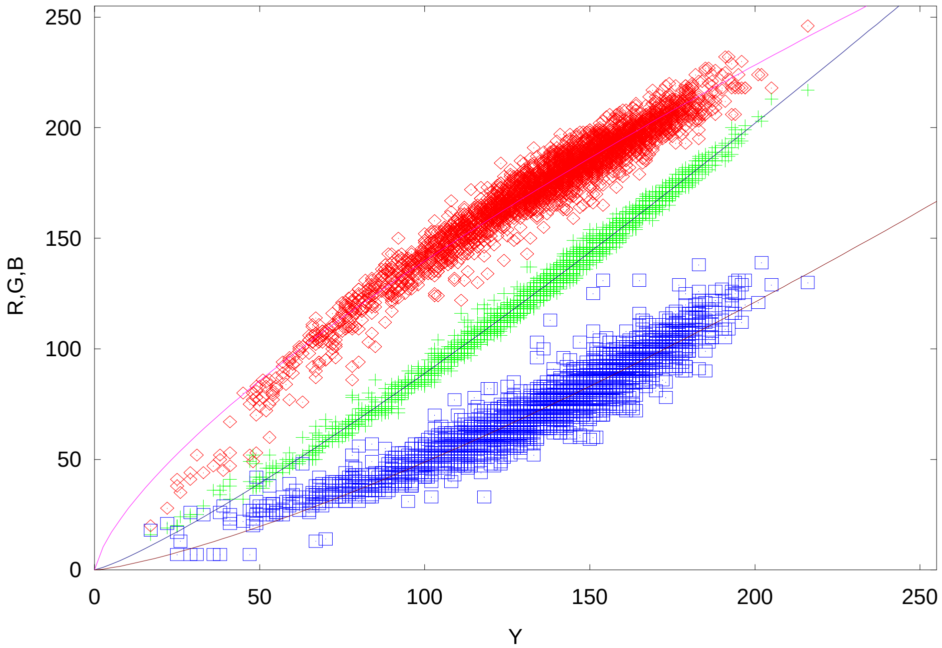
Examples of wood images

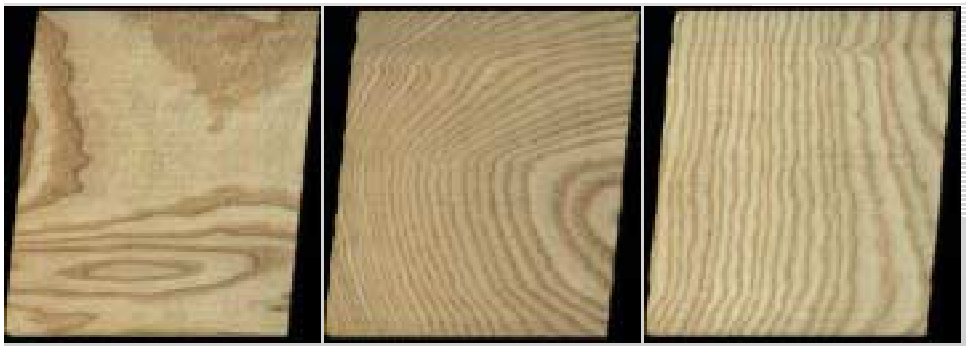
Samples with fitted curves

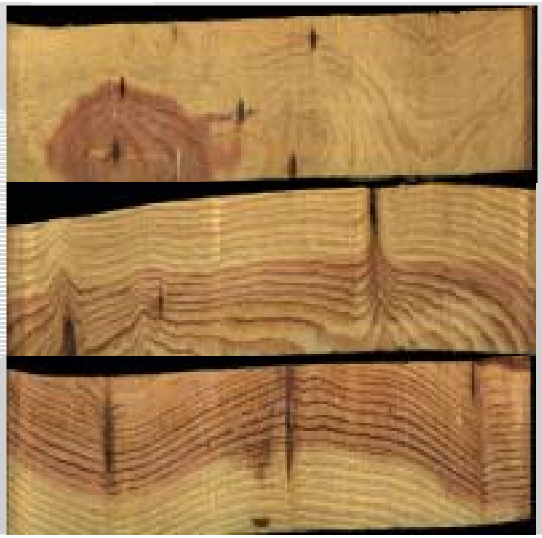
Model 1



Model 2





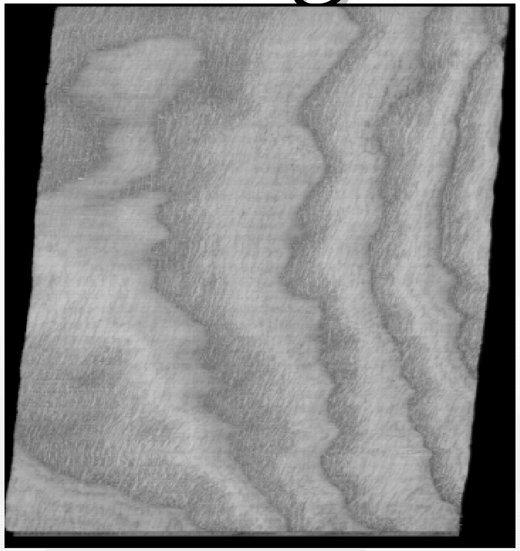


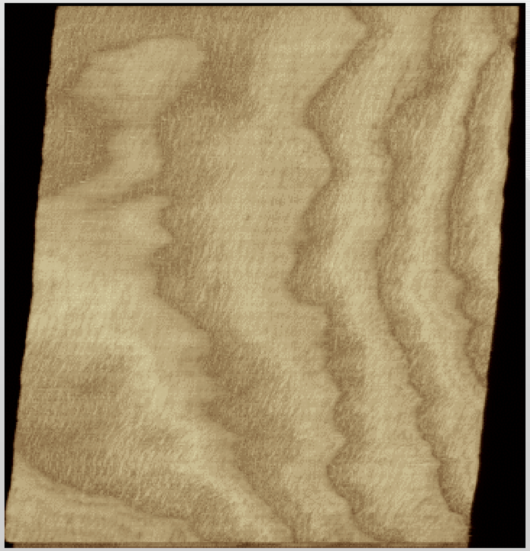
1000 points sampled from each example

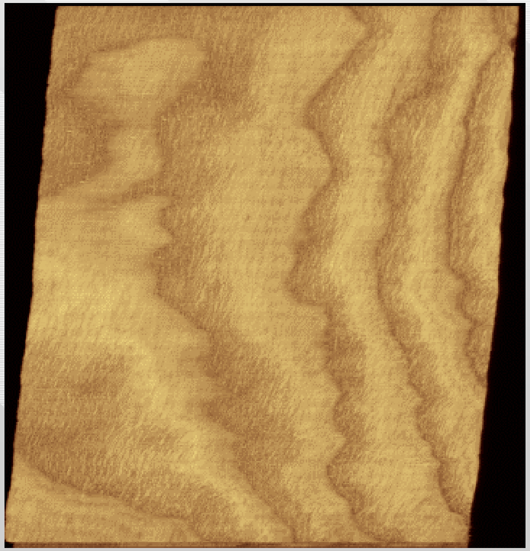
- 2. Reconstructing a colour image from a luminance image
  - For each luminance pixel, the value of R, G and B is obtained using the colour-luminance curve.

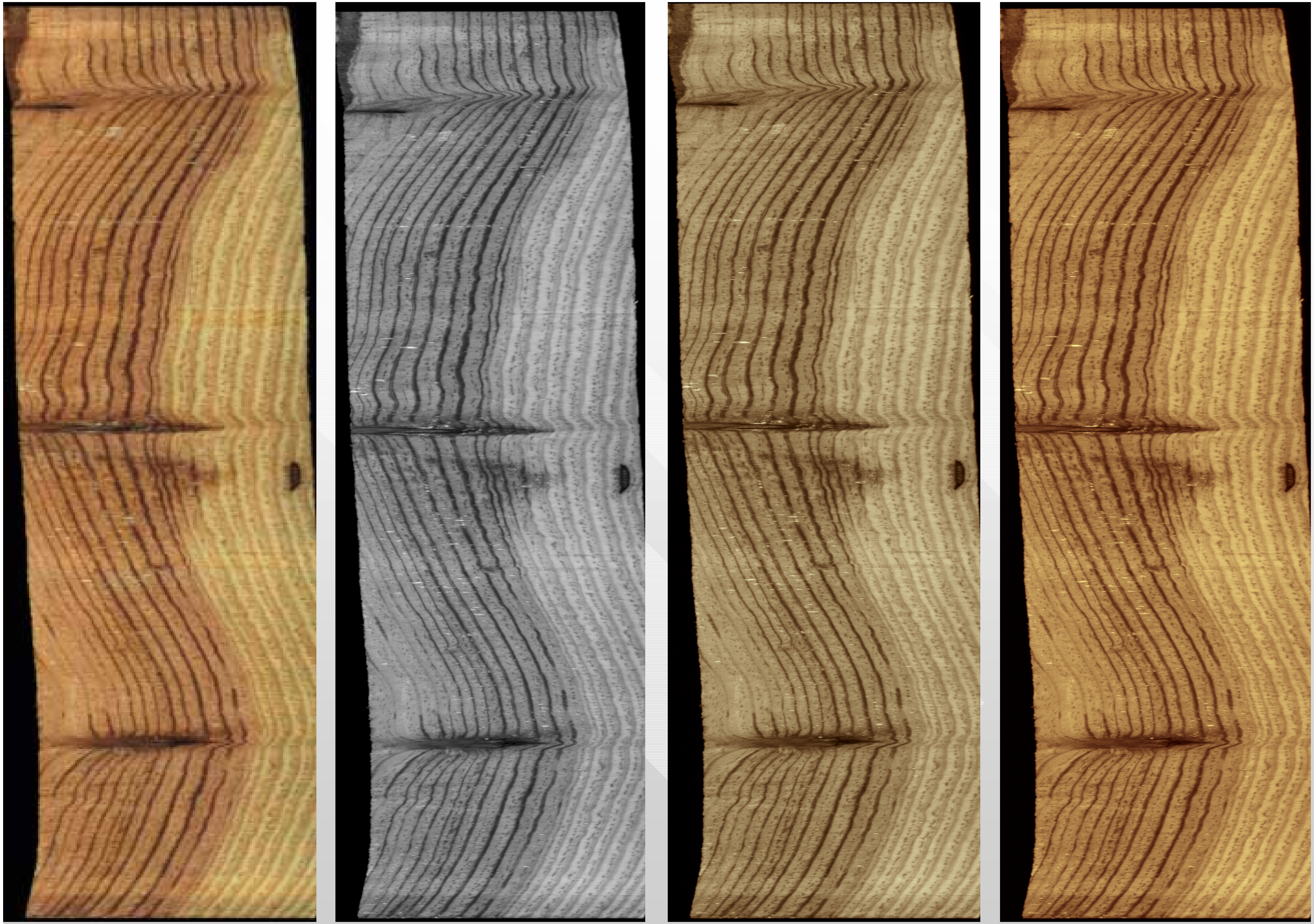
Reconstructed Images


Original

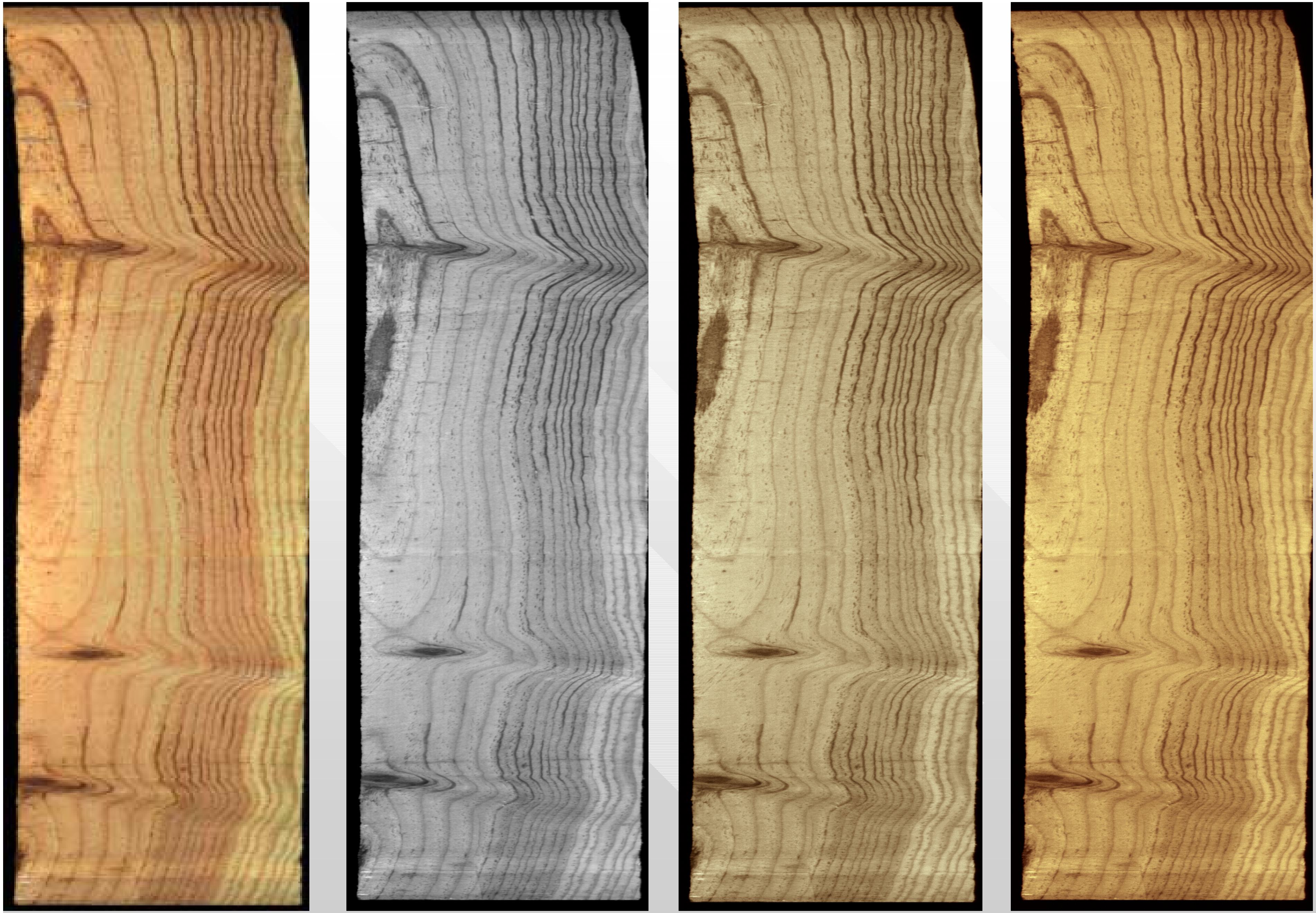

Luminance Image


Model 1


Model 2



Original Luminance Image Model 1 Model 2



Original Luminance Image Model 1 Model 2

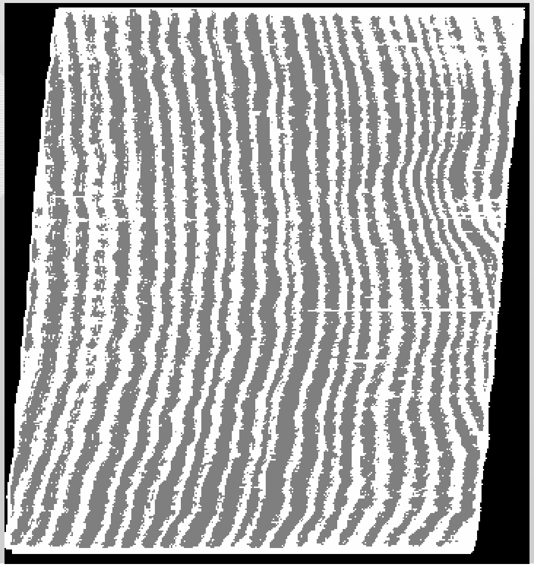
Colour Segmentation

- Used the *k*-medoid algorithm to group the samples into a number of groups
- A separate model was applied to each group

- The *k*-medoid clustering algorithm
  - [Kaufman & Rousseeuw, 1990]
  - an improvement on the *k*-means algorithm
  - chooses a representative object (medoid) for each class from the data set
  - A point is placed in a group if its Euclidean distance to the group medoid is smaller than the distance to the other group medoids

k-medoid algorithm applied to wood images (2 groups)

There is not a marked visual improvement in using two models for the wood images, as the single model reconstructions are already very good



The technique applied to other images

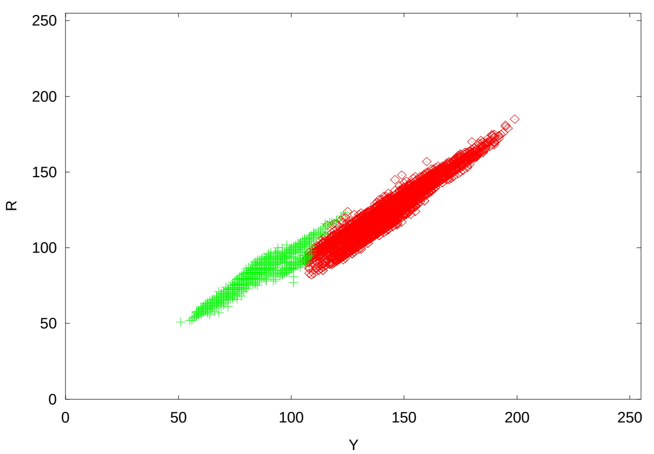
John Constable - View at Epsom (1809)

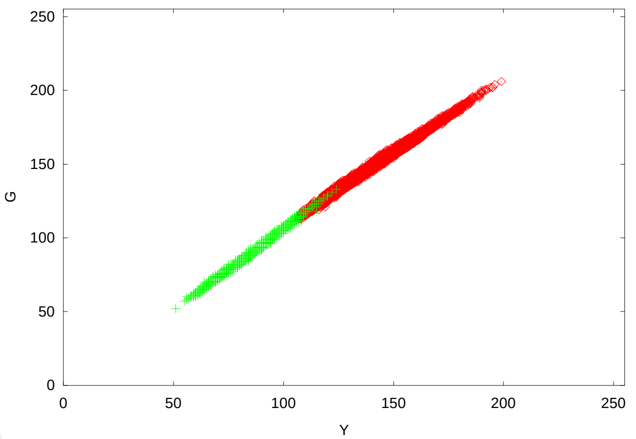
Colour - Luminance plots

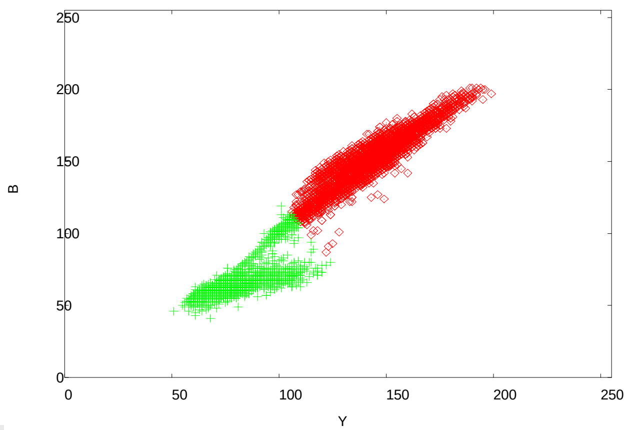
Red

Green

Blue

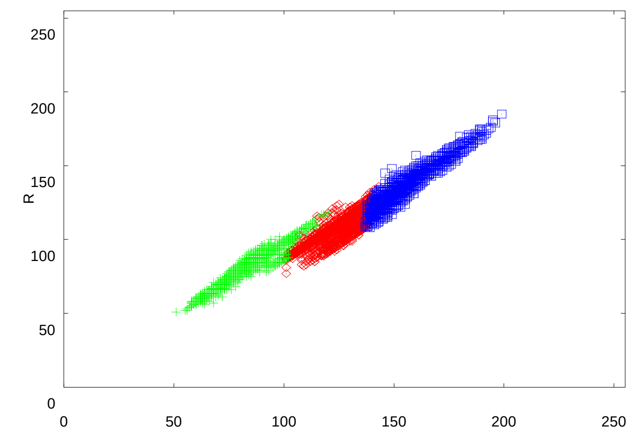


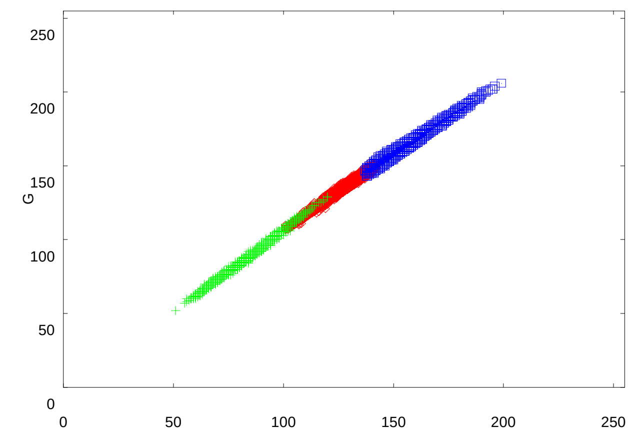


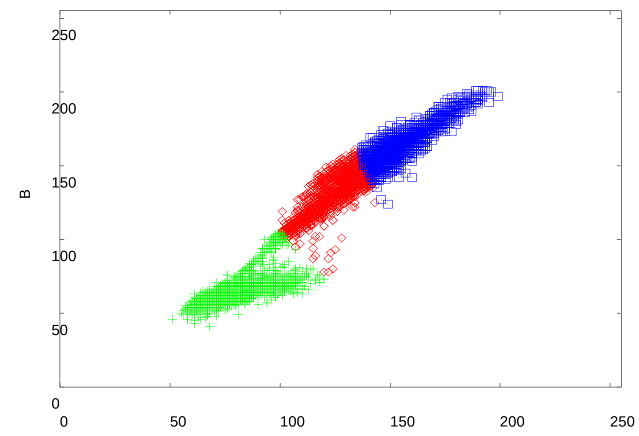


2 groups

10 000 points



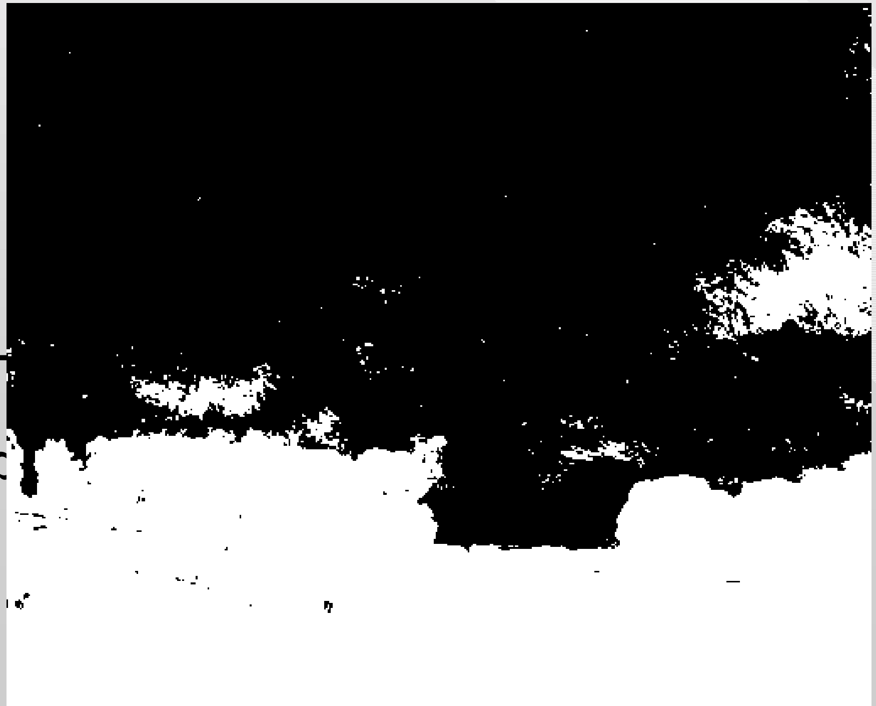




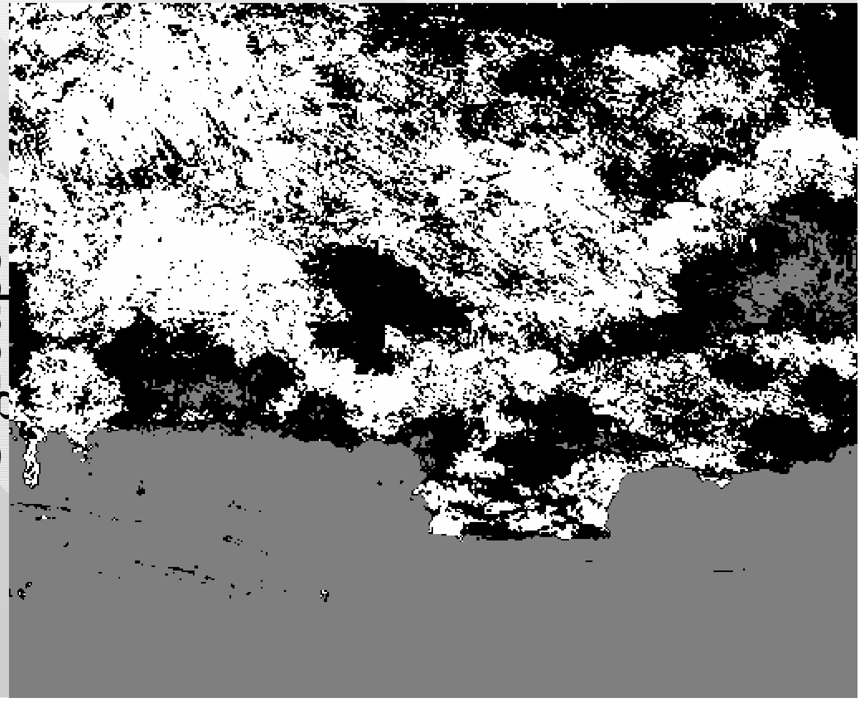
3 groups

Original

2 groups



3 groups



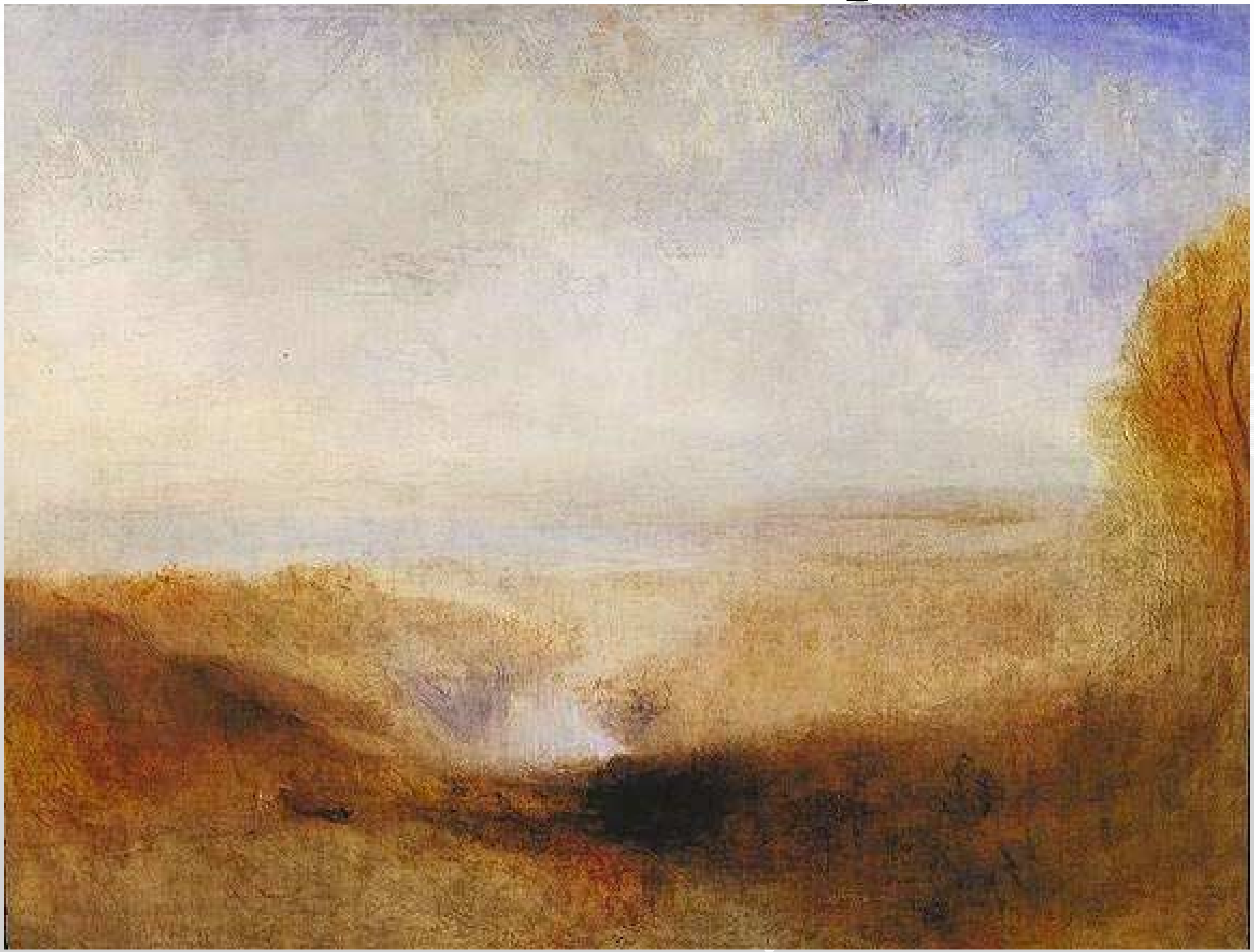
Original

1 group

2 groups

3 groups

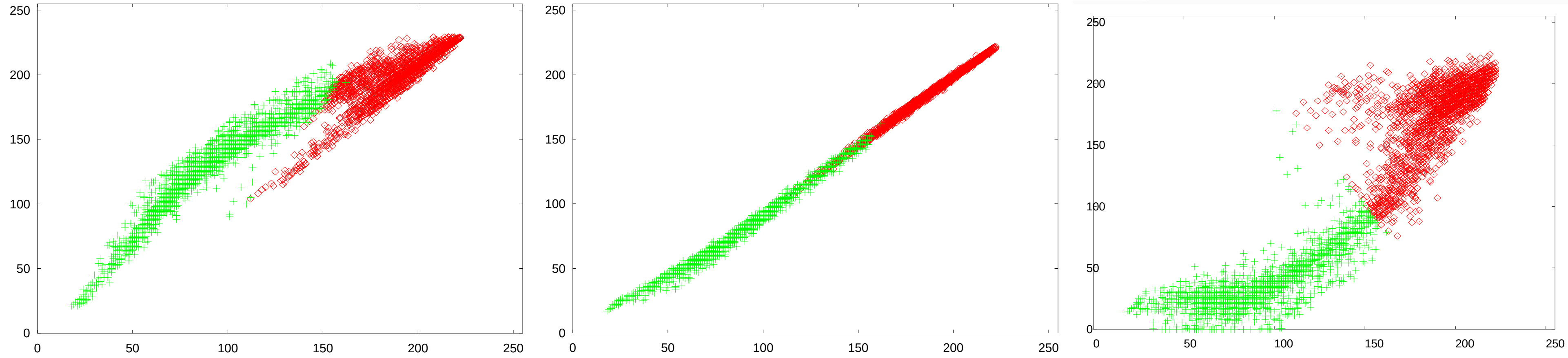
Another example



Joseph Turner - Landscape with a river and a bay in the distance (1845)

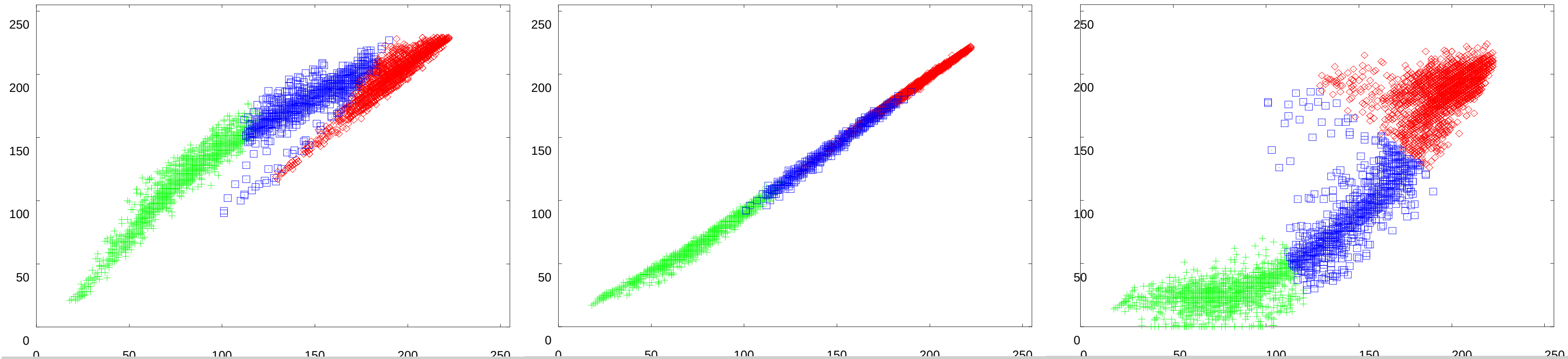
Colour - Luminance plots

Red Green Blue

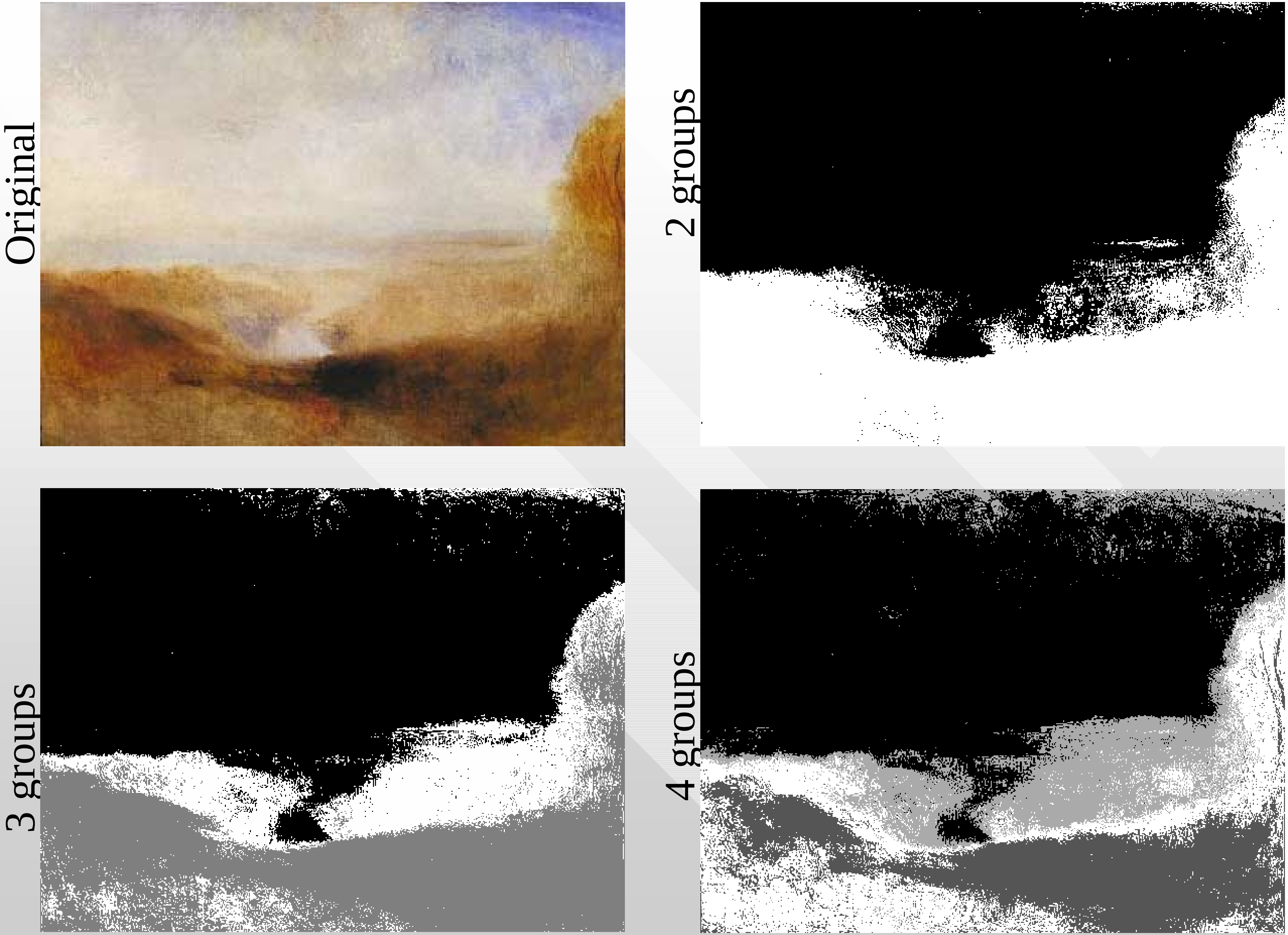


2 groups

5 000 points



3 groups


Original
2 groups
3 groups
4 groups

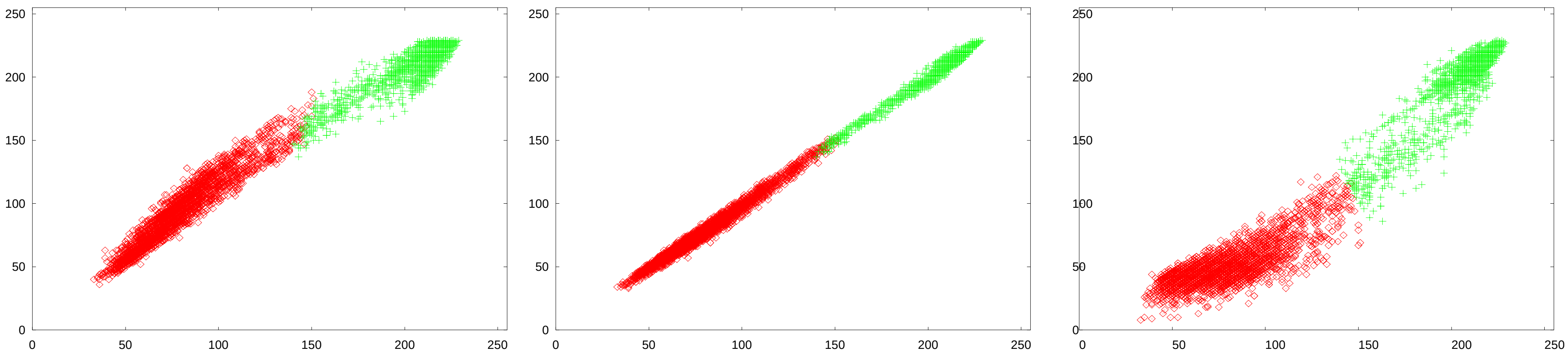

Original
2 groups
3 groups
4 groups

Example 3

Lionel Bicknell Constable - Near Stoke-by-Nayland (1850)

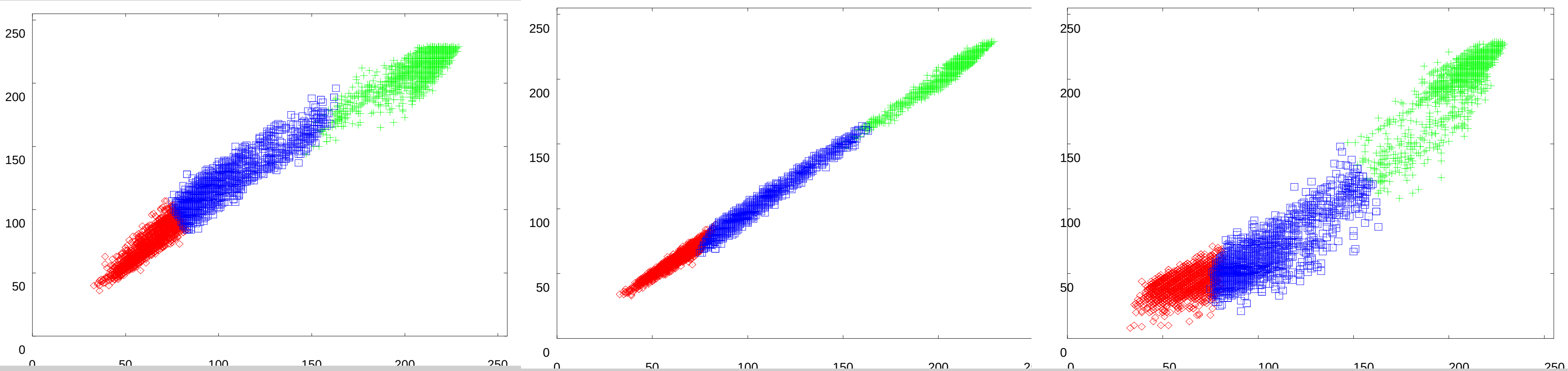
Colour - Luminance plots

Red Green Blue



2 groups

5 000 points



3 groups

Original

2 groups

3 groups

Original

1 group

2 groups

3 groups