2D Convolution

Robert B. Fisher

School of Informatics

University of Edinburgh

2D Convolution
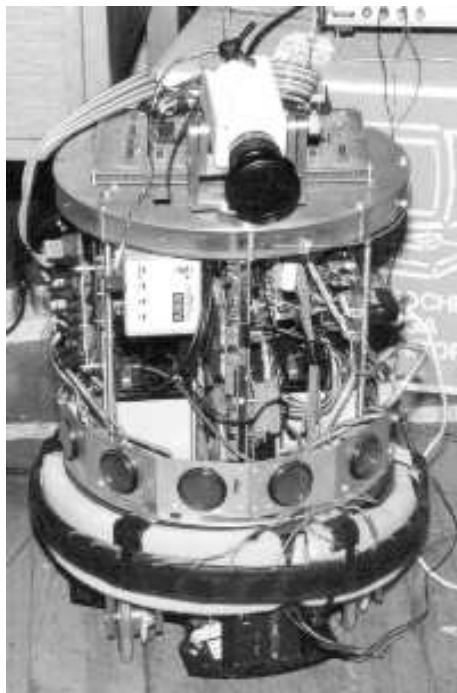
Applies 2D mask to 2D image

Still weighted sum

Choice of weights determines the effect

$$Output(x, y) = \sum_{i=-N}^{N} \sum_{j=-N}^{N} weight(i, j) * input(x - i, y - j)$$
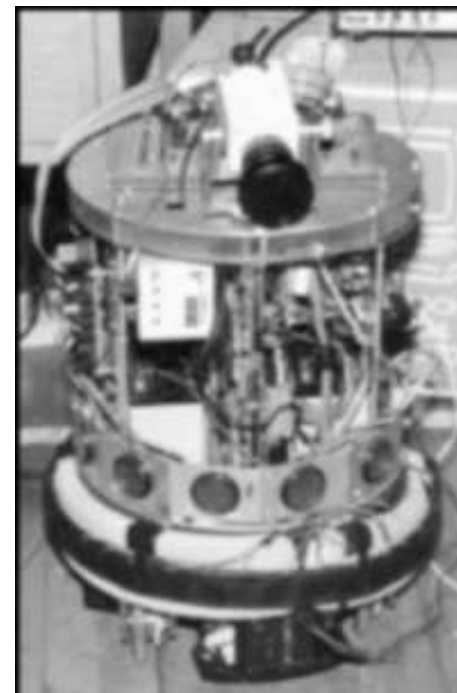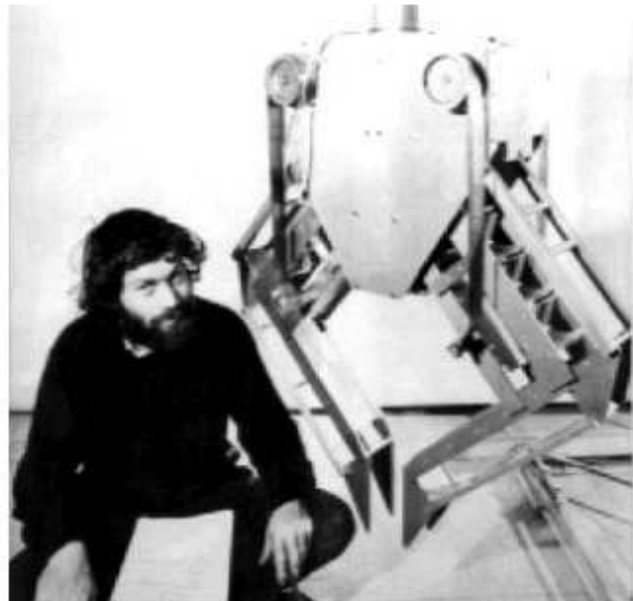
2D Convolution - Smoothing

$$\frac{1}{273} \quad \begin{array}{|c|c|c|c|c|} \hline 1 & 4 & 7 & 4 & 1 \\ \hline 4 & 16 & 26 & 16 & 4 \\ \hline 7 & 26 & 41 & 26 & 7 \\ \hline 4 & 16 & 26 & 16 & 4 \\ \hline 1 & 4 & 7 & 4 & 1 \\ \hline \end{array}$$
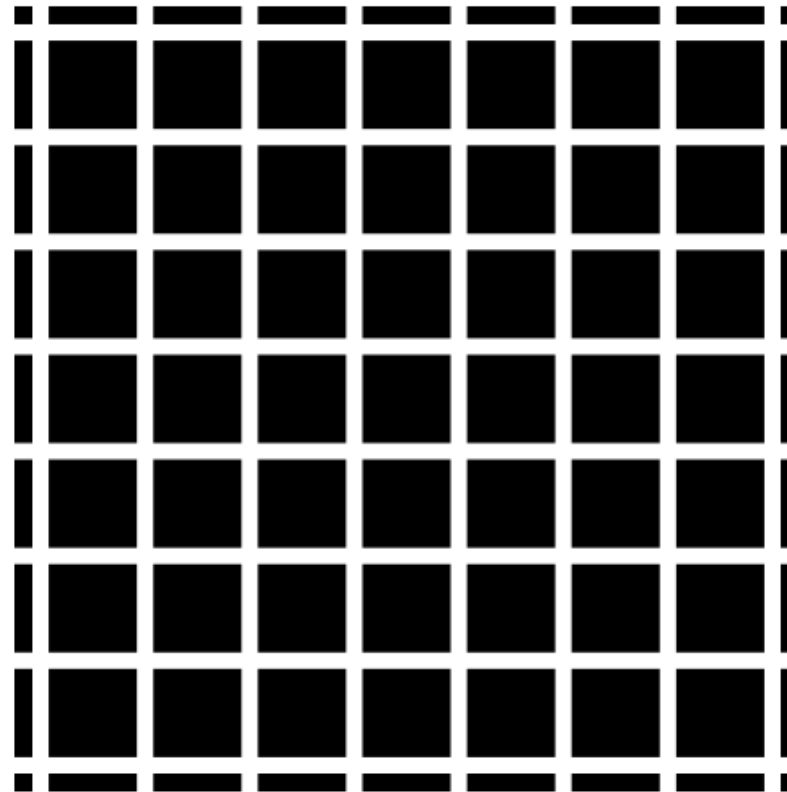
Convolution for Edge Detection

Convolution 'Explains' Illusions

Edge enhancement in human vision

Centre-surround receptors - convolved with retinal image

Hermann grid illusion – full explanation more complex

Slide credit: Bob Fisher

Lecture Overview

1. Convolution extension for 2D

2. Two of many applications: smoothing and edge detection

Slide credit: Bob Fisher