

EYE TRACKING: A PERCEPTUAL INTERFACE FOR CONTENT BASED IMAGE RETRIEVAL

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Overview

- Problem Statement
- Objectives
- Scope of the Work
- Overview of the Visual Attention Model
- Initial Experiment – Approach and Results
- Status
- Future Work

Problem Statement

- How can we make use of human visual behaviour to provide a new paradigm for content based image retrieval?

Problems with Information Searching

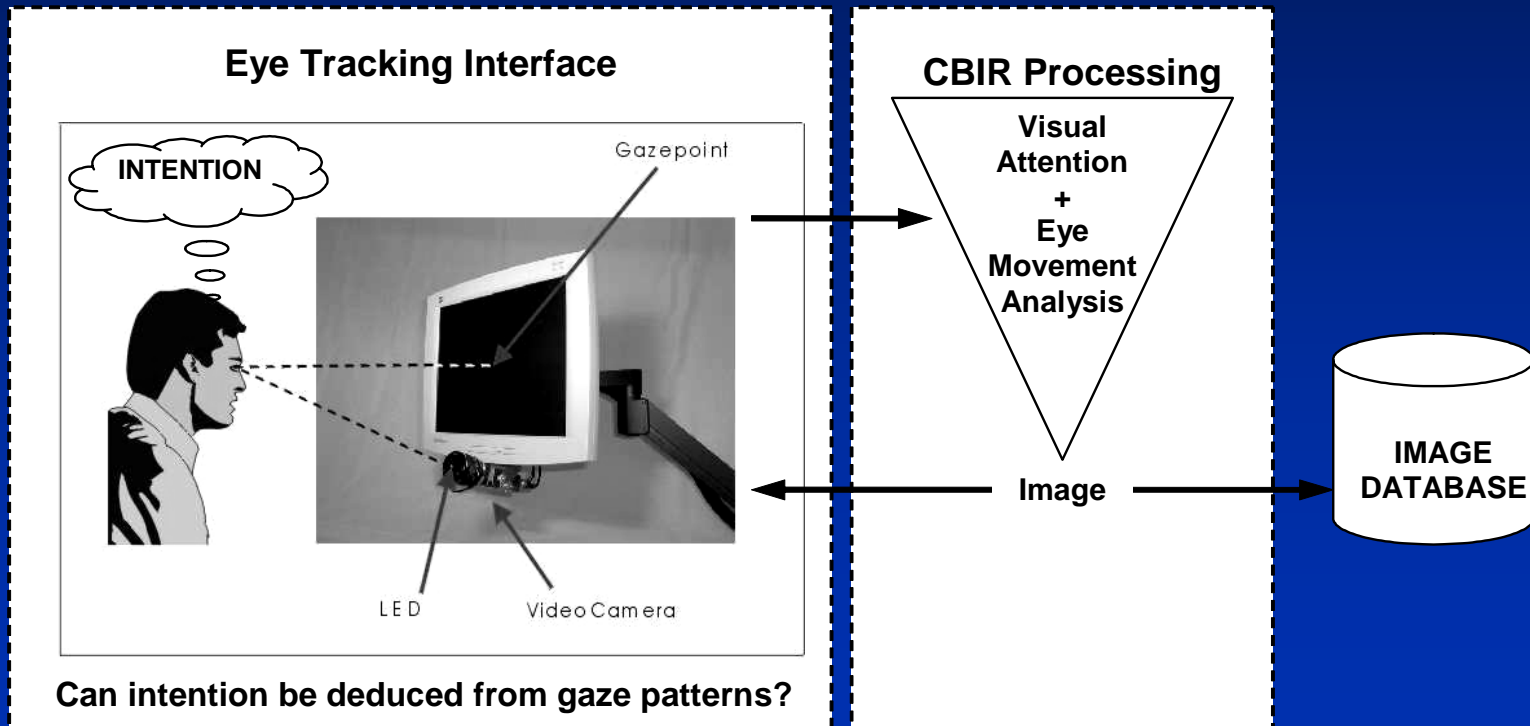
- Initiating a good query
- Feature measurements don't reflect the human visual system

Proposed Solution

- Visual Query Formulation
- Combination of Image Analysis and Eye Tracking data may yield a more efficient and effective CBIR interface.

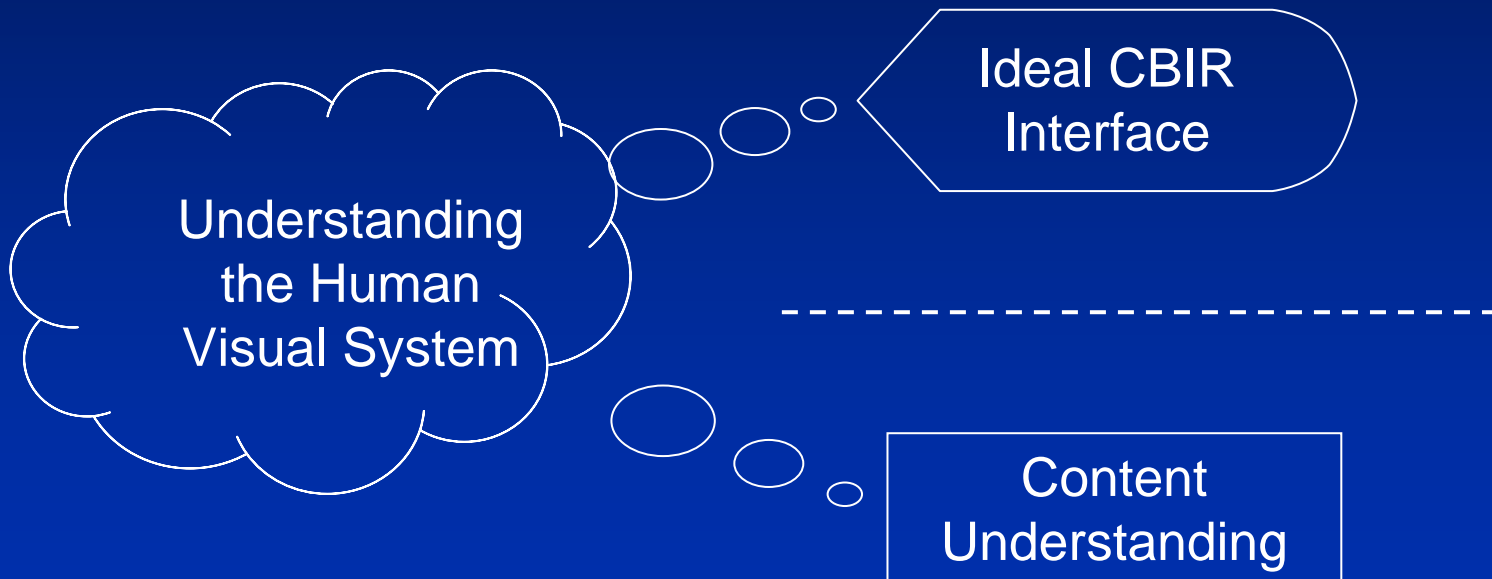
Objectives

The aim of this research is to provide a rapid and natural interface for searching visual digital data in a CBIR system.

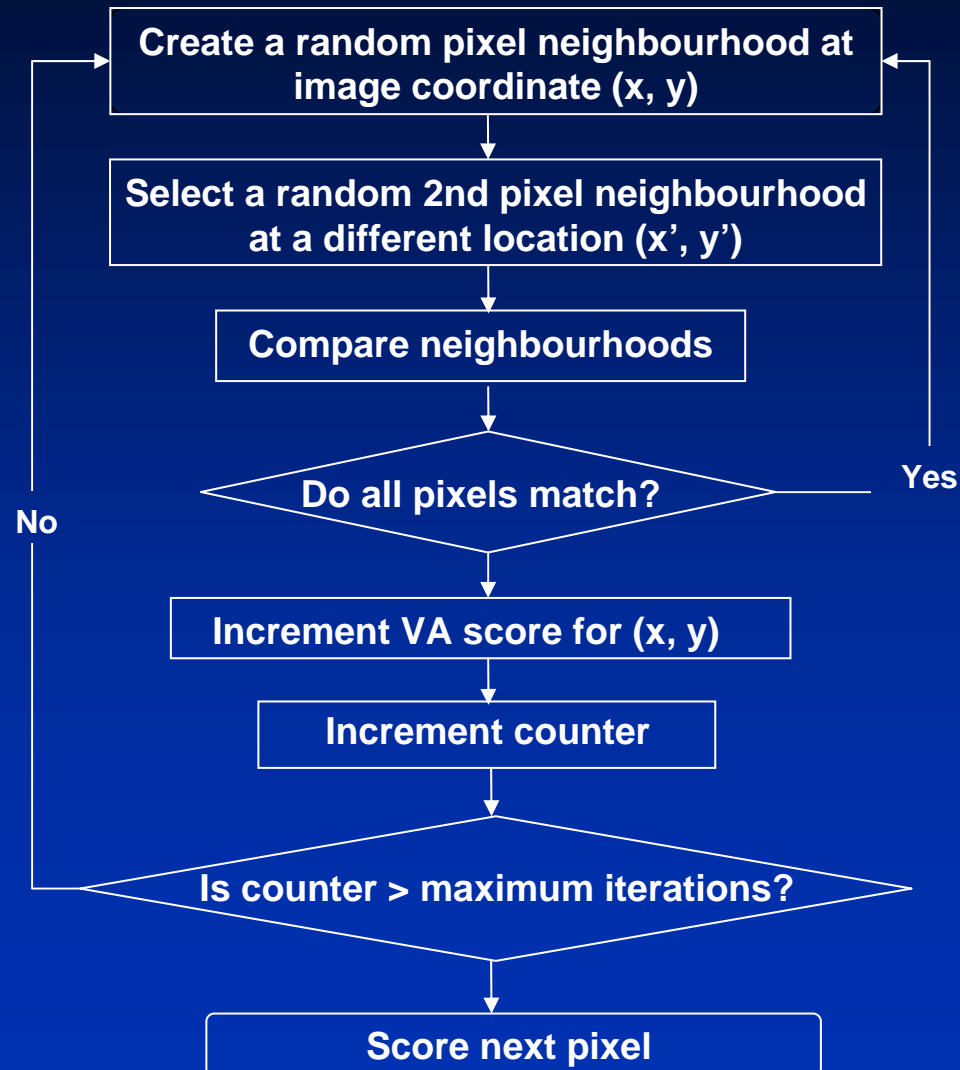


Scope of the Work

- Human Computer Interaction
- Visual Perception
- Image Analysis



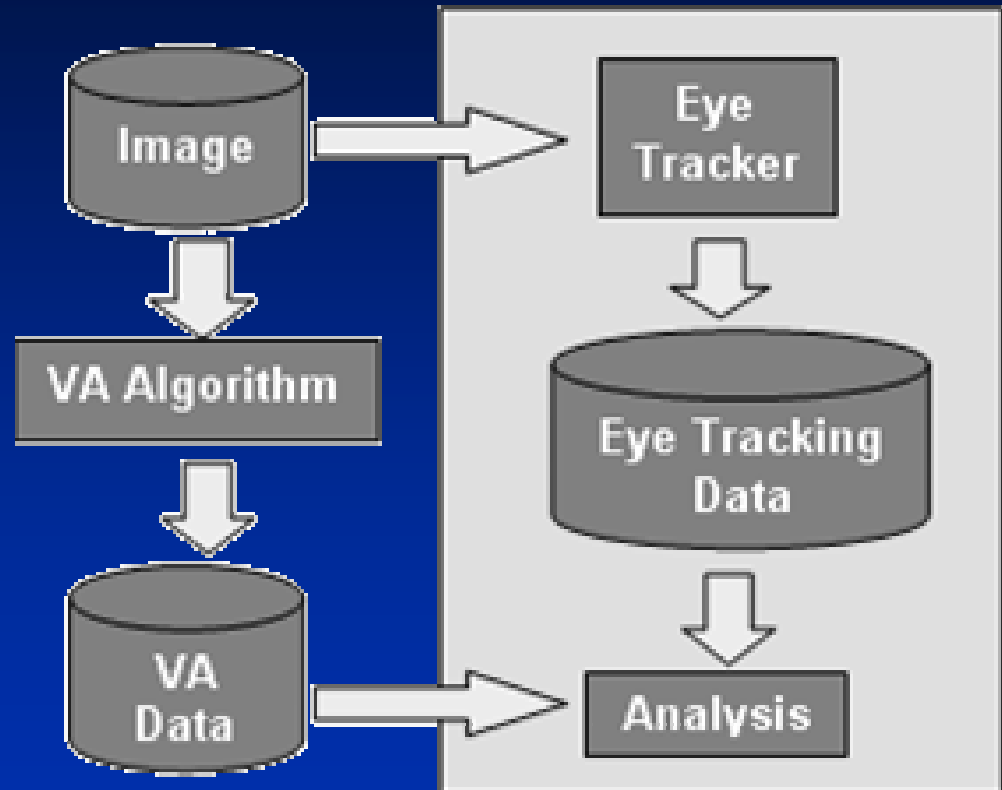
Overview of the VA Model



Preliminary Experiment - Process

Aim

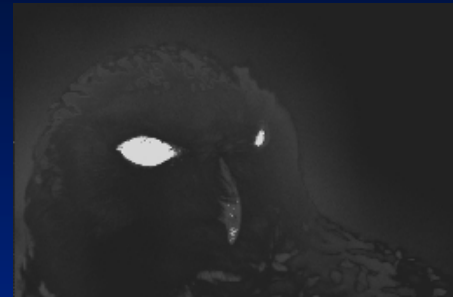
Detect differences in human gaze behaviour arising from varying image content.



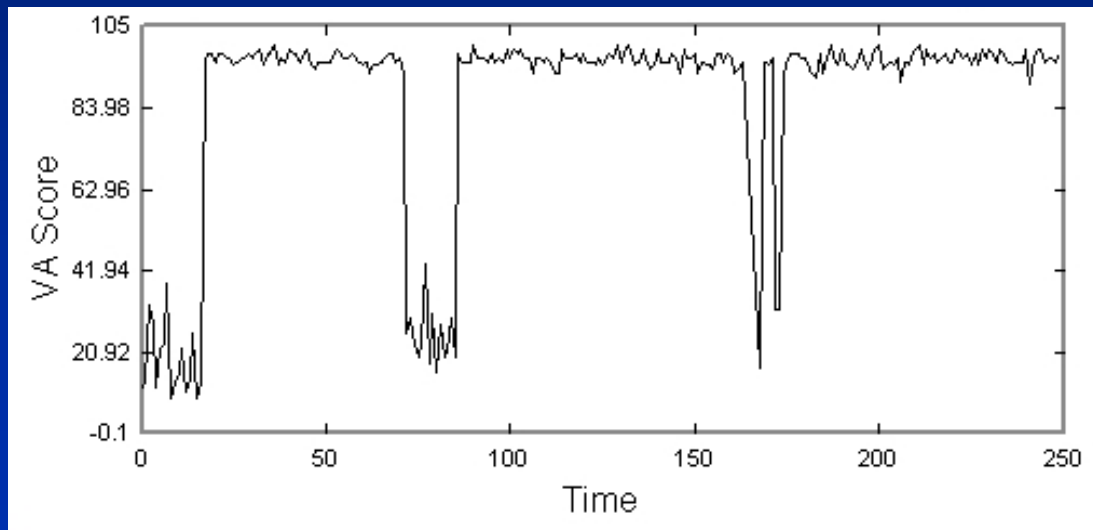
Results with obvious ROI



Original Image



Visual Attention Map



Graph of Visual Attention Score with Time

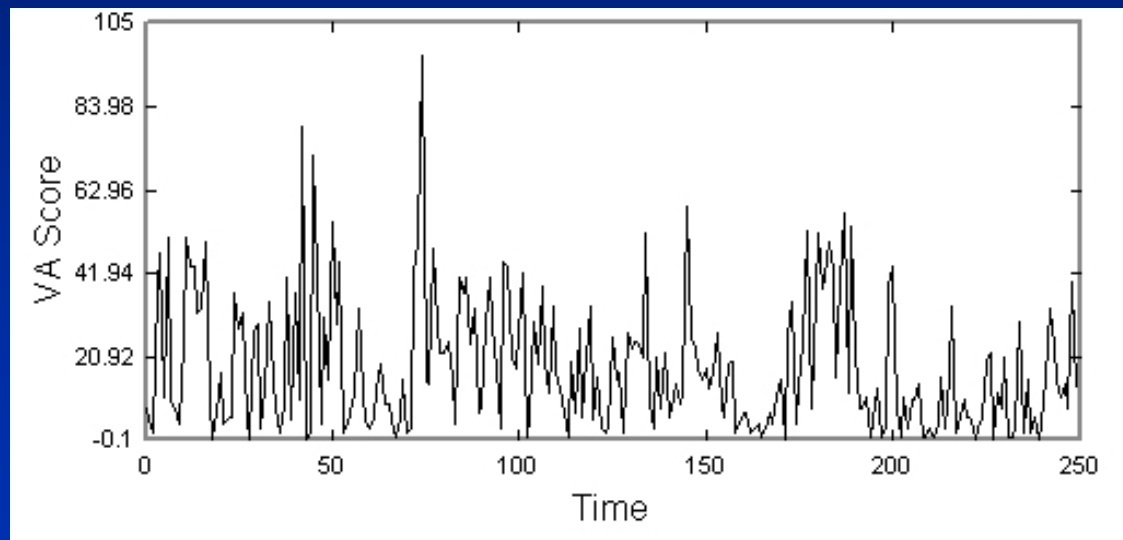
Results with unclear ROI



Original Image



Visual Attention Map



Graph of Visual Attention Score with Time

Results

- Statistical Treatment

The variance v measures the average spread or variability of the data series x .

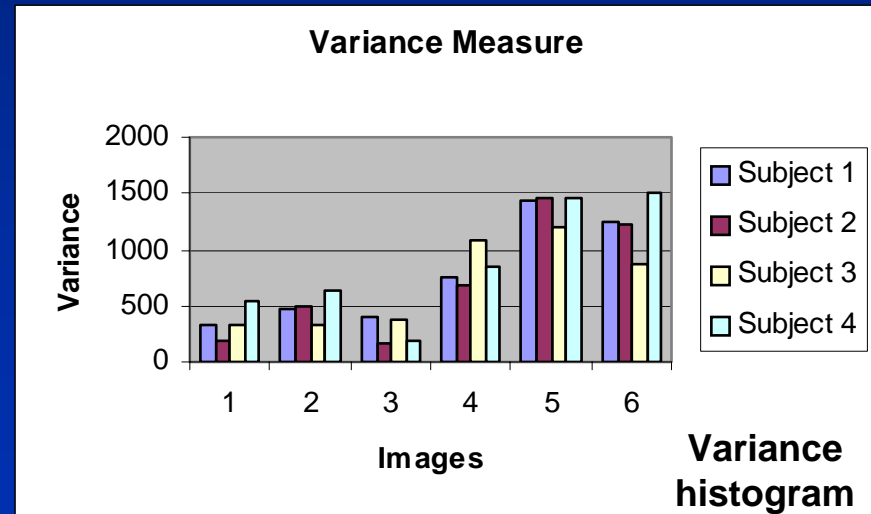
The variance of the VA score (x) over time is given by v where

$$v = \frac{n \sum x^2 - (\sum x)^2}{n(n-1)}$$

Results

The variances of the VA scores for the duration of the display over the six images for four subjects.

		Subjects			
		1	2	3	4
Unclear ROI	Image1	325	193	333	532
	Image2	479	496	328	629
	Image3	389	175	365	197
Obvious ROI	Image4	741	687	1094	857
	Image5	1432	1453	1202	1466
	Image6	1246	1226	862	1497



Status

- The first experiment revealed that there is a higher variance in Visual Attention scores over time on images with obvious Regions of Interest.
- Initial feedback from London Communications Symposium 2003 paper led to acceptance of paper at the International Conference on Pattern Recognition 2004.
- MPhil-PhD Transfer Report nearing completion.
- British Telecommunications Technology Journal paper to appear in July 2004 publication.

Future Work

- Refinement of experiment (accuracy, statistical significance).
- Exploration of task oriented visual activities.
- Investigate statistical techniques for combining eye tracking and visual attention data efficiently.
- Interpretation of eye movement data: fixations, saccades, pursuit, covert and overt attention, blinks, pupil diameter, etc.
- Producing software demonstrators for searching and retrieving content as well as exploring eye tracking patterns during visual search.

Thank you for Listening!
Discussions?

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