

Modelling the geometric resemblance of objects in CAD-drawings (extended abstract)

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When data mining large databases with images or drawings of objects, there is a need to search for objects with a geometric resemblance. This is typically the case in systems for image retrieval based on image content. In this paper we review existing image retrieval systems based on image content and give an overview of what strategies these existing systems employ for modelling resemblance of objects and images. Typical searchable features include geometric (shape), colour, intensity, contextual and statistical features.

Our interest in this field is inspired by a problem within the aluminium industry where a large database of CAD-drawings of produced aluminium sections should be made searchable. Our problem is limited compared to the general problem of image retrieval based on image content as we only need to consider geometric features. The actual CAD-drawings only contain exact and deterministic contour information of the actual objects and hence contain no colour or intensity information. Additional contextual information is available as we also have production data available in our database and hence may use production data as an extra criteria for resemblance. Resembling sections are expected to produce in a similar fashion or manner. We may even be interested in using the geometric features together with other production variables to build prediction models of certain production parameters such as speed, yield or scrap.

Different aspects of visual resemblance of shapes must be considered

- Perception
- Interpretation
- Representation

- Context
- Symmetry
- Complexity
- Structure

One of the main problems is that two different objects in the database may resemble each other in very different manners. Visual resemblance is not easy for humans to understand as many factors influence our notion of it. In this paper we discuss what marks a good geometric feature. We firmly believe that the following properties of a feature are very important

- Invariance to a transformation group (Euclidean, similarity, affine or projective)
- Uniqueness & completeness
- Degradation when subject to different types of noise or small changes of shape representation
- Computationally the feature should be robust, have low complexity and be easy to implement
- Orthogonality and spanning ability
- The level of abstraction which influences the ease of use

At last we discuss how to choose geometric features which could be used for modelling geometric resemblance. Little work has previously been done in assessing how to choose geometric features for such database searches. Different approaches discussed include correlation analysis, multivariate regression as well as formulating the problem as a constrained optimisation problem.