Björn Gottfried

Shape from Positional-Contrast

Bildwissenschaft

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Björn Gottfried

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Characterising Sketches with Qualitative Line Arrangements

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Preface

Graphical queries for the purpose of searching for pictorial information are of growing interest in areas where pictures provide valuable information, including, for instance, design, architecture, and engineering. Sketching graphical queries is a natural way of revealing the visual appearance of objects one has in mind. The problem which arises is identifying necessary shape properties of sketches, that is, those properties which are not accidental but are necessary for specifying a particular object property. This problem arises in particular because sketches are imprecise, and often distorted by the artistic limitations of the sketcher.

From the theoretical point of view the concept of *pictorial space* applies. In this context, new concepts are required, in particular for dealing with imprecise shape information in the plane. Taking into account constraints imposed by pictorial space, a relation algebra of intersection-free relations is proposed, which allows reasoning about qualitative line arrangements in the plane. The theory is further developed for characterising polygons, by deriving a number of qualitative properties which aid in describing polygons qualitatively. Applying this theory, only line arrangements which are both readily sketched and easily perceivable are considered to be different. The notion of positional-contrast is introduced, which points out that the particular arrangements of line segments, i.e. their positions relative to each other, provide an expressive means of characterising necessary shape properties. The method developed in this work is applied in using graphical queries to search for historical objects. Specifying objects graphically, it is shown that the new method is capable of dealing with imprecise sketches by describing necessary shape properties using qualitative line arrangements, i.e. by taking into account positional-contrast.

Overall, the investigations which are carried out in this work pertain to the field of knowledge representation in artificial intelligence. The representation developed here sticks to ideas developed in the field of *qualitative spatial reasoning* — one of its principal goals being the representation of commonsense knowledge about the physical world. As is common practice in this field, knowledge about the domain in hand is made explicit in order to arrive at efficient reasoning methods. Here, we confine ourselves to a representation of shape information and make explicit knowledge about our object of research, namely about imprecise shape information in picture space.

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