An Equilateral Triangle Recognition System

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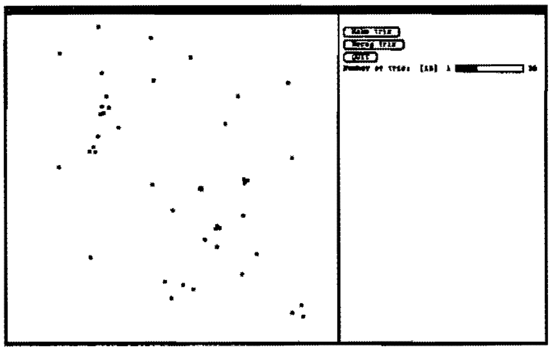

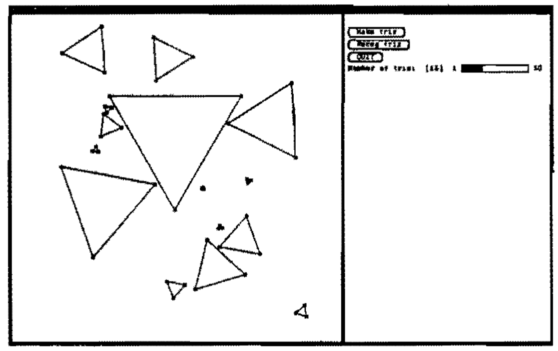

This demonstration shows our general approach to object recognition as applied to the simplified domain of equilateral triangle recognition. The input to the system is the collection of vertices of a set of non-overlapping equilateral triangles whose size, location, and orientation are chosen randomly. A control specifies the number of triangles in the input. The goal of the system is to parse this set of vertices into equilateral triangles.

Our general approach to recognition is to view it as the construction of an interpretation structure from stored models which explains the input data. Eventually the form of these models will be determined by a learning system, but in this demonstration they were constructed by hand. At each stage in the construction of an interpretation there are usually many models which may be added to the interpretation structure. Our approach is to evaluate each of these possibilities and to greedily add the model with the most explanatory power in the current context. This strategy causes the system to interpret unambiguous parts of the input very quickly, but to defer interpretation of ambiguous parts until late in the process. In this way the unambiguous parts can provide a context within which to disambiguate the ambiguous parts. The system can use both bottom-up and top-down information, at each stage choosing that which is most appropriate.

The equilateral triangle domain requires the solution of two of the general difficulties which beset recognition systems. First, the individual models come from parameterized families. By varying the location, orientation, and scale, one obtains a four-parameter family of model equilateral triangles from which instances must be recognized. Second, there is ambiguity in the assignment of input features to models. Each vertex could belong to many possible triangles and these must compete for inclusion of the vertex. The prior knowledge built into the system is that nearby vertices are more likely to belong to the same triangle than those which are far from one another. In this way the recognizer tends to find the small triangles first, and their vertices then no longer compete in the construction of the larger triangles. Current research is aimed at solving more complex tasks which have extra features missing from this example: using learning algorithms to build up the model structures, dealing with incomplete information (eg. occluded objects), applying evidential reasoning to uncertain models, model structures which are multi-level component hierarchies, and the existence of complex constraints between model components.