















in the update function.

The first preliminary conclusion suggested by the results presented here is that for similar data representations a neural network is not measurably better than a standard symbolic pattern matching approach. This should not necessarily lead to the rejection of neural networks. Our research is predicated on the supposition that neural network and symbolic processing are mutually complementary rather than mutually exclusive. The real contribution of neural networks is in the conceptual paradigms and programming techniques which they present. Neural network languages and hardware will, most likely, take their place along side other tools on the system designer's workbench, and be used as needed for the specialized class of problems for which they are best suited. The system that we have presented could have been conceptualized in any one of a variety of approaches. We feel, however, that the use of the neural network paradigm presented the problem and the system architecture in the most transparent way possible. Neural networks provide tools for the high level abstraction of a difficult problem.

#### 4. FUTURE DIRECTIONS

This paper represents a relatively new direction for our research group and is still in its beginning stages. The preliminary investigations and analysis of various models is vital in the formulation of an accurate assessment of the powers, limitations, and requirements of these models. We plan continued testing of existing models for this domain as well as further development of models which show promising results.

It is important to realize that a key component of the solution to the recognition problem involves data representation issues (e.g. pixel vs. feature presentations) rather than just data manipulation issues (neural network vs. symbolic algorithms). Future work will involve definition of additional knowledge modules. Some of the new modules will be based on neural network paradigms. Others will be designed around parallel distributed approaches to more standard character recognition schemes such as contour and stroke analysis. Many will be a combination of the two. It is hoped that a combination of methods will yield, through fusion, a better system than could be constructed from one technique alone.

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