The progress in information technologies enables applications of artificial neural networks even in areas like navigation and geographical information systems, telecommunications, etc. This kind of problems requires robust recall of - possibly incomplete - spatial data. In this context, spatial patterns can be geographic maps, room plans, etc. Strategies for processing of spatial patterns can be based on associative memories. However, the performance of traditional associative memories (usually Hopfield-like networks) is very sensitive to the number of stored patterns and their mutual correlations. In this thesis, we design and implement the so-called Hierarchical Associative Memory (HAM) model in order to avoid limitations imposed by processing of a large number of mutually correlated patterns. The proposed model consists of several associative memories grouped into layers. A suitable strategy applied during the network dynamics allows reliable processing of large amounts of spatial data. To evaluate the performance of the proposed HAM model, extensive simulations are carried out. The storage and recall abilities of the HAM model are studied experimentally and thoroughly compared with several other models of associative memories.