PREFACE

The Graph is one of the most widely used mathematical structure in engineering and science because of its representational power and inherent ability to demonstrate the relationship between objects. Graph matching is the process of finding the similarity between the two graphs. It has a wide range of applications of object identification in various graph-based representations. Graph matching is broadly classified into two types, exact and error-tolerant graph matching. While exact graph matching requires a strict correspondence between nodes and edges of the two graphs the error-tolerant matching allows some flexibility to measure the similarity between two graphs from a broader perspective. Due to non-availability of the efficient graph matching solutions, various approximation and suboptimal algorithms have been proposed.

The objective of this work is to introduce the novel graph matching techniques using the representational power of the graph and apply it to structural pattern recognition applications. We present an extensive survey of various exact and inexact graph matching techniques. A category of graph matching algorithms is presented, which reduces the graph size by removing the less important nodes using some measure of relevance. Graph matching using the concept of homeomorphism is presented, it uses path contraction to remove the nodes with degree two from all simple paths of input graphs in which every node except first and last have degree two.

We present an approach to error-tolerant graph matching using node contraction where the given graph is transformed into another graph by contracting smaller degree nodes. Node contraction is the process of removing a node and its associated edges provided that the node is not an articulation point. It leads to a reduction in search space required to perform graph matching. We use this scheme to extend the notion of graph edit distance, which can be used as a trade-off between execution time and accuracy requirements of various graph

matching applications. Experimental results show that the algorithm achieves efficiency without disturbing the topology of graphs too much.

We describe an approach to graph matching by utilizing the various node centrality information which reduces the graph size by removing a fraction of nodes from both graphs based on a given centrality measure. Depending on the structure and properties of various graph dataset, we can choose the appropriate centrality measure to reduce the size of the graphs. Experiments show that different centrality criteria lead to a different saving in computation time and classification ratio. Depending on the application requirements, suitable centrality measure can be selected to achieve the best performance.

The graph matching problem is inherently linked to geometry and topology of graphs. We introduce a novel approach to measure graph similarity using geometric graphs. We define the vertex distance between two geometric graphs using the position of their vertices and show it to be a metric over the set of all graphs with vertices only. We define edge distance between two graphs based on the angular orientation, length and position of the edges. Then we combine the notion of vertex distance and edge distance to define the graph distance between two geometric graphs and show it to be a metric. We describe a geometric graph isomorphism algorithm using the above concept of graph similarity to perform exact graph matching. Finally, we use the proposed graph similarity framework to perform error-tolerant graph matching. The experimental results show that this graph matching approach is promising to graph dataset in which every node has a coordinate position in a two-dimensional plane.