CHAPTER VI

CONCLUSION

A new aspect of 3D realizability problem is studied. Given a realizable object hidden under the crossing lines, extracting a realizable object from such lines. The given lines are obtained from either a scanned image or a photographic image after applying some line extracting process. However, the process of perfect line extraction from the image is not the main concern of this study. We assume that all lines are perfectly extracted and are given to our algorithm. A set of crossing lines and line crossing locations are given as the input. Our studied problem defined different constraints as the classical realizability problem. First, all given lines can be extended to infinity inside an image frame. They can cross one another to form segments. Second, each crossing point can be considered as a junction and each line segment can be viewed as a segment (edge) of a line drawing object. Some of these segments and points are redundant and not applicable to the realization. The problem is which crossing points and line segments are significant and essential in the realization.

A rule-based approach algorithm is proposed in identifying and extracting a 3D realizable object from a given set of crossing lines under an assumption that each given line is relevant and comprised of at least one segment of the corresponding extracted 3D realizable object. The extracted object is a single solid object of which the hidden segments of the extracted object are not shown. The algorithm consists mainly of five processes. The significant junctions formed by at least three lines crossing and the significant segments that link between the significant junctions are identified in the first process to be the candidates of the significant faces of a 3D realizable object. The candidates of the significant faces are verified as the real significant faces using the first set of rules in the second process. In the third process, the essential junctions and essential segments are identified to be the potential essential faces. The second set of rules is applied in the forth process to verify the potential essential faces as the real essential faces. The remaining problem lines are verified by the final rule in the fifth process. The unused lines are also considered before the identified 3D realizable object is extracted.

The proposed algorithm is tested with 169 polyhedral line drawing images obtained from Varley's thesis. All tested object images have the features of 3D realizable objects as mention in Section 3.1. The algorithm is able to correctly extract all the relevant line segments and points up to 94.68 percent. This means 160 objects out of 169 objects are correctly identified. There are two objects out of 169 objects partially successfully extracted and seven objects out of 169 objects unsuccessfully extracted. The time complexity of the proposed algorithm is *O(mn)*, where n is the number of initial crossing points counted from m crossing lines.

All rules that are used in the algorithm to verify and remove the over-identified significant faces and essential faces are based on observation on the characteristics of 3D realizable objects. Rule $E2$ is most frequently applied. From 160 objects, 94 objects need rules $E2$ in removing the over-identified junctions and segments. Whereas, rule $SE1$ is least frequently applied. From 160 object, 9 objects need rules $SE1$ in removing the over-identified junctions and segments.

However, some additional rules are needed to improve the accuracy in case the unsuccessfully extracted objects. In case of partially successful extracted object, the unique extracted 3D realizable object can be obtained if the assumption on the position of view is provided. In addition, the algorithm and rules should be developed to cover with more features of the realizable objects as the further study. Especially, the features of the objects when T-junctions or K-junctions are included.