6.1 Summary

Specific learning disabilities (LD) have been recognized in some countries for much of the 20th century, in other countries only in the latter half of the century, and yet not at all in other places. As our world becomes more complex, the knowledge base increases and the concepts more abstract, an increasing number of children will experience difficulty and be assumed to have a learning disability. In India, about 10% of children enrolled in schools having LD. Learning disabilities are formally defined in many ways in many countries. It is a neurological condition that affects a child’s brain and impairs his ability to carry out one or many specific tasks. Learning disabilities affect children both academically and socially. These may be detected only after a child begins school and faces difficulties in acquiring basic academic skills. An affected child can have normal or above average intelligence. Our challenge will be to
alter our parenting and teaching approaches so that their potential contribution to our collective lives is not forfeited. The concept is still new in many developing countries. Since no national census of the learning disabled has been taken in India, it is difficult to collect their actual number. In India, the learning disabled children are not identified using reliable tests and the research conducted in learning disability has been primarily done over the last two decades only.

In this thesis, various machine learning techniques are used to analyze the symptoms of LD, establish interrelationships between them and evaluate the relative importance of these symptoms. To increase the diagnostic accuracy of learning disability prediction, a knowledge based system based on statistical machine learning or data mining techniques according to the knowledge obtained from the clinical information is developed. The basic idea of the developed tool is to increase the accuracy of the learning disability assessment and reduce the time used for LD assessment. The tool has many advantages compared to the traditional methods to determine learning disabilities using check lists.

For improving the performance of various classifiers, we developed some pre-processing methods for the LD prediction system. No others have done this type of work and it is very relevant in medical diagnosis system. A new system based on fuzzy and rough set models are also developed for LD prediction. Here also the importance of pre-processing is studied. A Graphical User Interface (GUI) is designed for developing an integrated knowledge based tool for prediction of LD as well as its degree. The designed tool stores the details of the children in the student database and retrieves their LD report as and when required.
6.2 Contributions

This thesis makes several major contributions in technical, general and social areas as discussed below.

6.2.1 Technical contributions

i. New methods for LD prediction, based on machine learning techniques, are developed,

ii. New insights into the interrelationships between symptoms of LD, their relative importance and estimating the significance of each symptoms of LD

iii. Identification of the problems related to the classification accuracy of different classifiers,

iv. New algorithm based on correlation is developed for imputing missing values,

v. New models of LD prediction using fuzzy and rough sets,

vi. Modification of data preprocessing with J48 decision tree and neural network for LD prediction; and

vii. Developing of an integrated knowledge based tool for LD prediction,

6.2.3 General contributions

i. The research works done in the area of prediction of learning disabilities using knowledge based methods is very little compared to the magnitude of LD affected children,

ii. Based on the machine learning tool developed, the presence of learning disability in any child with its percentage can be determined,
iii. The class of LD like low, minor and major and the percentage of LD in each class can also be determined by this tool,

iv. The number of attributes is reduced by eliminating the unwanted and redundant ones by using Principal Component Analysis, which helps in reducing the time of classification,

v. The tool developed gives more accurate results in lesser time compared to the traditional assessment methods using check lists,

vi. The developed tool is very effective for finding the LD affected children from the large database; and

vii. This research work has also considered an approach to handle learning disability database to predict frequent symptoms of the learning disabilities in school age children.

6.2.4 Social contributions

i. The study will certainly contribute in the development of the nation as LD is a real stumbling block for a nation’s development process,

ii. The contribution of the study in early diagnosis of LD in children is critically important to identify and suggest remedial solutions to children/parents /teachers, which will ultimately help them to provide the child with best environment for them and they can learn successfully and become winners,

iii. The contribution of the study ultimately improves the confidence of children and helps in getting the social support to them; and

iv. As the developed tool is very user friendly, it can be used for LD identification by the parent/teacher/friends of the children.
6.3 Future Works

My future work focuses on Hybrid Computing approach and advanced features of fuzzy models for enhancing the tool to incorporate other assessment methods of LD, including formal assessments. If we enhanced the tool by incorporating these, all kinds of assessments can be done. The prediction will then be more accurate and the tool can be used by the teachers at school level itself or even by the parents or friends of the affected children. This work can be enhanced to other areas of medical diagnosis also. As this work is particularly for general assessment of LD, in future more work can be done to categorize the LD like dyslexia, dyscalculia, etc.

The developed tool is found very user friendly and it can be used by teachers at the school level itself or even by the parents. The results are found very beneficial to the parents, teachers and the institutions. They are able to diagnose the child’s problem at an early stage and can go for the proper treatments/counseling at the correct time so as to avoid the academic and social losses.