NEURAL NETWORKS FOR

NATURAL LANGUAGE PROCESSING

A Thesis submitted
for the award of the Degree of

Doctor of Philosophy

By

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to the

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CERTIFICATE

This is to certify that the thesis entitled **Neural Networks for Natural Language Processing** which is being submitted by **Mr. B. Krishna Murthy** for the award of **Doctor of Philosophy** to the **Indian Institute of Technology, Delhi** is a bonafide record of research work under my guidance and supervision

The thesis has reached the standard of fulfilling the requirements of the regulations relating to the degree. The results obtained in this thesis have not been submitted to any university or Institute for the award of any degree or diploma.

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Abstract

The thesis aims at development of Neural Network models for Natural Language Processing (NLP). NLP involves development of computer models for syntactic and semantic analyses. Through this research it has been shown that Neural Network models are a promising tool for NLP. Parsing is an essential part of any NLP system.

This research work introduces Neural Networks for Indian language processing. Indian languages are inflectional and relatively free word ordered. An efficient technique is lacking for parsing of Indian languages. So far parsers based on only conventional techniques have been developed. The advantage of using Neural Networks for NLP is that it is a one time processing effort.

Cascading of Backpropagation (BP) networks has been introduced in this thesis. Based on this, models have been designed and implemented for processing of two Indian languages namely, Tamil and Telugu. Highly successful results have been achieved. Concepts of Genetic Algorithms have been employed in training Multilayered Neural Networks for Indian language processing. The genetic operators have been transformed to Neural Network parameters. The advantages of both Genetic Algorithms and Neural Networks have been best utilised. The models have been designed in such a way that they can be used for processing any language.

In order to eliminate the hidden layer in a Multilayered Neural Network , Radial Basis Function (RBF) networks have also been designed for parsing. A new distance measure viz. lexical distance, suited for natural language processing has been introduced. A model for syntactic analysis using multistage heterogeneous networks namely, a mixture of RBF and Backpropagation

networks has been designed. Evolutionary learning algorithm has been designed for RBF networks which allow classification of patterns belonging to more than one class.

In order to speed up the computational time for training, models have also been designed using Functional Link Networks (FLN) for category prediction. It has been observed that FLN takes around 1/10th of the computational time taken for training using Backpropagation network. It has been shown that FLN is useful for Example Based Machine Translation, by designing of a system for translation of simple sentences from one Indian language to another.

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