Chapter 1

Introduction

1.1 Motivation

Seismic reflection method is one kind technology often used in analyzing stratum structure. This method is producing the seismic wave by a near-surface explosion of dynamite, mechanical impact, or vibration. Seismic waves transmit downwards from the surface and then return to the surface after reflection from interfaces between formations having different physical properties. The reflected seismic waves are recorded by the detecting instruments. The detecting instruments are called receivers. The signal received by receivers is processed by some seismic signal processing operation. And then we can get the seismic data that we can process for some purposes, for example, horizon linking, pattern recognition, …, etc.. Linking the reflection points in seismic data can depict the structure of stratum, and then can analyze the stratum structure. It is very useful for the analysis and prediction of the earthquake and prospecting and exploring for oil. Using computers to deal with a large amount of seismic data can get the fast and objective result.

Associative memories can store a lot of relevant patterns. Information can be stored in the network in a distributed way. It has the ability of tolerating errors. When we input the memorized pattern to it, it can output the corresponding output pattern. When we input the pattern contained noise or the incomplete pattern, it can output the correct output pattern too, so it can be used for classification and recognition. We design cellular neural networks to behave as associative memories, and then we use it to recognize bipolar patterns. The value of each element of bipolar patterns is 1 or -1. We can use the associative memory for seismic pattern recognition. Because during the process of collecting seismic data, it is usually that some noise will be mixed in the data, so using the associative memory to recognize the noisy seismic data can help us to analyze the stratum data correctly.

1.2 Structure of the Thesis

This thesis is divided into two topics basically, which are using cellular neural networks for seismic horizon linking and pattern recognition respectively. Chapter one is the introduction, which introduces the research motivation and research background; Chapter two introduces cellular neural networks, which states basic structure and properties of cellular neural networks; Chapter three introduces the method of using cellular neural networks to deal with seismic horizon linking and experimental results; Chapter four introduces the method of using associative memories designed by cellular neural networks to recognize patterns and experimental results. Finally, chapter five gives conclusions to this research and future works about this research.