PREFACE

The use of pattern recognition has become more and more important in seismic oil exploration. Interpreting a large volume of seismic data is a challenging problem. Seismic reflection data in the one-shot seismogram and stacked seismogram may contain some structural information from the response of subsurface. Syntactic/structural pattern recognition techniques can recognize the structural seismic patterns and to improve seismic interpretations.

In 1-D seismic data analyses, different Ricker wavelets represent different pattern classes. We can describe the Ricker wavelets into strings or sentences of symbols. Then we can parse the testing string by grammar or compute the distance between testing string and training string, and assign the testing string to its correct class. In 2-D seismic data analyses, the primary reflection from the geologic structure of gas and oil sand zones can show a seismic structure (bright spots). The bright spot pattern can be processed and represented as a tree representation. Then we can use the tree recognition system to recognize this kind of seismic pattern.

In 1-D syntactic analyses, the methods include (1) the error-correcting finite-state parsing for the recognition of the 1-D string of Ricker wavelets, (2) the modified error-correcting Earley's parsing and (3) the parsing using match primitive measure for the recognition of the 1-D attributed string of the wavelets, and (4) the Levenshtein distance computation and (5) the likelihood ratio test for wavelet recognition. In the 2-D tree automata, the methods include (6) the weighted minimum-distance structure preserved error-correcting tree automaton and (7) the modified maximum-likelihood structure preserved error-correcting tree automaton for syntactic parsing of the 2-D seismic bright spot patterns. Finally we present (8) a hierarchical system to recognize seismic patterns in a seismogram.

Syntactic seismic pattern recognition can be one of the milestones toward geophysical intelligent interpretation system. The syntactic methods in this book can be applied to other fields, for example: medical diagnosis system. This book has been written for geophysicists, computer scientists and electrical engineers.

I thank Kevin M. Barry of Teledyne Exploration for providing real seismic data. I am indebted to my graduate students, especially at the University of Houston — University Park (1983–1988), in many helpful discussions. At last I thank Professor C. H. Chen at the University of Massachusetts at Dartmouth. He encouraged me to write a paper, "Syntactic pattern recognition," in the book, *Handbook of Pattern Recognition & Computer Vision*, edited by C. H. Chen, L. F. Pau, and P. S. P. Wang, World Scientific Publishing, 2nd edition, 1998/99. Then using the syntactic approaches to the seismic exploration data, I can finish this book. This book was partially supported by the National Science Council, Taiwan, under grant NSC-78-0408-E009-16, NSC-80-0408-E-009-17, NSC-81-0408-E-009-12 and NSC-82-0408-E-009-065.

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