Prospect Explorer: An Exploration Neural Analysis Tool

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ABSTRACT

Exploration data analysis plays a vital role in acquiring, mapping, targeting, prioritising and management of mineral prospects. Given the high stakes and intense competition within all areas of the global mining industry, informed business decisions on the acquisition, exploration and exploitation of prospective ground are more important than ever. The ability of being able to gain efficient usage of the multi-component exploration data that can be acquired at ever increasing rates is fundamental to implementing successful management strategies.

Neural computers are good at analysing large amounts of data to identify relationships, recognise patterns, associations and anomalies, and make predictions automatically. Applied to the various forms of exploration data, they provide a powerful analysis tool that is orders of magnitude more time-efficient than current, more manual tools.

This article presents Prospect Explorer, a patented neural software tool from Neural Mining Solutions Pty. Ltd. This exploration tool takes an alternative approach to data analysis and visualisation, automating the detection and prioritisation of anomalies and the relationships between their components.

Results from a blind trial of a Project Area are given which clearly demonstrate the ability of Prospect Explorer to quickly, effectively, and consistently locate mineral deposits.

INTRODUCTION

Current methods of data processing, analysis and interpretation rely heavily on the ability of experts and are time consuming. The two main reasons for this are the inability of devices to simultaneously display all the layers of data for interpretation, and the time it takes to analyse the results.

Image processing specialists are continuously developing more advanced computing methods for preparing data for the specialist interpreter. These processed data sets are displayed for interpretation by devices that have limited simultaneous input capabilities (a CRT has three colour guns, printers/plotters have between three and four colours). Consequently, the number of layers of information (inputs) are restricted by the capabilities of the display device. Complex algorithms compiled by experts have to be used to allow information derived from multi-layered data sets to be displayed simultaneously. These algorithms are naturally limited in their effectiveness by the talents of the image processing experts.

Similarly, the interpretation of these data sets is limited by the talent and time resources of the interpreters. Conventional procedures involve making numerous overlays each depicting limited sets of data at the same scale and projection, individually placing them on a light table and tracing patterns of relative significant difference, and then integrating the interpreted results from each overlay with those of all of the others. This process is cumbersome, inconsistent, subjective and very time-consuming.

Attempts to overcome these inadequacies have been made since the advent of Geographical Information Systems (GIS) by using a procedure called Potential Field Mapping. This process automates, to some extent, the integration component of the procedure outlined above by removing some of the inconsistencies and subjectivities. However, the usefulness and time demands of this method are still limited by the talents of the data processors, the interpreters and the GIS software programmers (i.e., experts).

NEURAL COMPUTING

Neural computing is a technology based on the processes of the biological brain and has many human-like qualities. Since a neural computer learns from data, it does not need to be programmed with fixed rules or equations. It provides a radically different way of producing rapid solutions to complex problems. It has the ability to turn data into internally held relationships which can then be analysed and viewed. The mining industry frequently faces problems characterised by uncertainties brought about by chemical and biological phenomena. Until recently, using computer technology to help the human geologist has been difficult, lagging behind most other process industries.

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Conventional computing approaches are effective when the nature of the problem and the steps that lead to its solution are well known and can be explicitly described. However, it is not always possible to describe the solution to a problem and all the possible forms that the inputs into that problem can take. These are typically tasks which humans perform well but computers have traditionally found impossible to achieve. Neural computers, with their ability to learn from examples rather than needing to be explicitly programmed, offer a means of making such tasks tractable to a machine.

Today, neural computing has removed some of the fundamental limitations of conventional systems. The ability of the neural computer to learn from experience, rather than having to be explicitly programmed, means they possess superior intelligence to conventional computing, augmenting and enhancing existing manpower and systems.

PROSPECT EXPLORER

Created by geologists, Prospect Explorer is a patented exploration software tool designed to help automate the detection of anomalies in survey data, using the latest neural computers.

Prospect Explorer provides geologists with the means to rapidly analyse and find anomalies from large quantities of survey data with minimal effort. Figure 1 depicts a functional block diagram of the software.

Prospect Explorer provides the following analysis functions:

- neural anomaly detection
- neural cluster identification
- neural correlation analysis
- neural fuzzy search, and
- neural Relationship Explorer.

A wide range of survey import and interpolation algorithms exist. The geologist is supported by an interactive visual user-interface which provides 2-D and 3-D plots, zooming, selection of survey data for interpolation, region of interest selection for analysis, and many other features. Prospect Explorer provides a complete cohesive exploration environment for analysing survey data for likely prospects.

ANALYSIS SEQUENCE

A typical Prospect Explorer analysis follows this sequence:

1. Load survey data

   Many different spatially related types can be loaded, each containing multiple layers of data (e.g., soil survey for copper, lead, zinc, etc.).

2. Interpolate scatter survey data onto a regular grid using a suitable interpolation method
   - Start by covering a broad area with perhaps a coarse grid
   - Move onto finer grids, perhaps choosing restricted areas with a more appropriate algorithm for more detailed analysis.

3. Neural-analyse for: Anomalies/Clusters/Correlations (particularly for those that are coincident with known mineral deposits).

4. Use these results for fuzzy search patterns or develop specific search patterns based on expert geological knowledge.

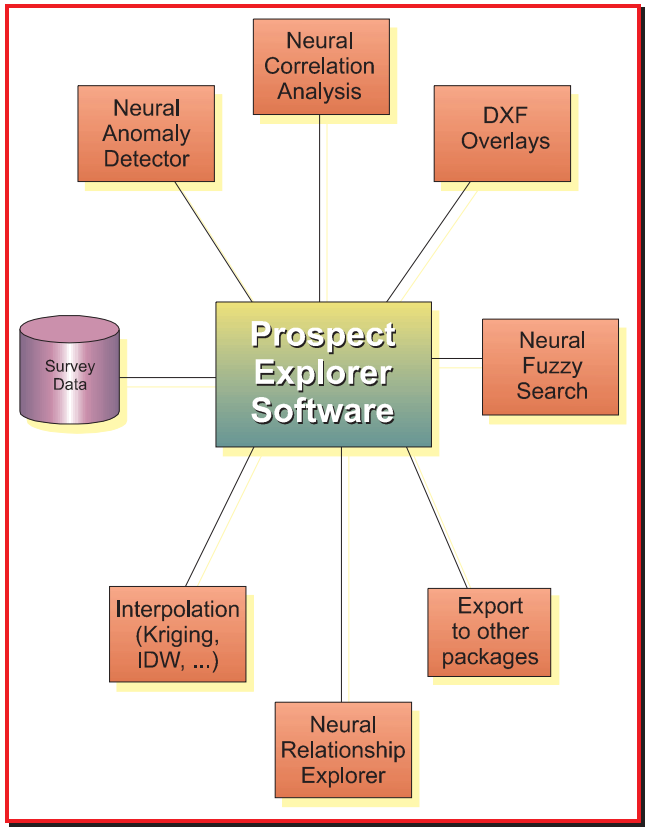
5. Study localised detail using Relationship Explorer or repeating analysis loop based on restricted area interpolation.

6. Visualise results using 2-D/3-D plots, altering colour contrast, zooming, blanking regions where little survey data exists, overlaying survey data, etc.

7. Qualify results by checking their relative reality values particularly where individual data sets have different spatial coverages.

8. Output results for use in other formats/applications
   - Raster images for incorporation within GIS systems
   - Hard-copy plots using standard Windows 95 drivers
   - Data outputs for use in other processing tools (ER Mapper, etc.).

The key feature of Prospect Explorer is that it takes many types and layers of survey data covering huge geographical areas, and generates single layers of information — anomaly locations, correlation, etc.



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