The use of a multi-agent learning system to analyse embedded context in qualitative data for decision-making.

by

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Submitted in fulfilment of the requirements for the degree

MAGISTER COMMERCII (Informatici)

in the faculty of Economic and Management Sciences at the

University of Pretoria

PRETORIA

June 2000
I declare that

The use of a multi-agent learning system to analyse embedded context

in qualitative data for decision-making

Is my own work and that all sources that I have used or quoted have been indicated and acknowledged by means of complete references.
Acknowledgements

I would hereby like to express my sincere thanks and gratitude towards:

- Prof HL Viktor for her leadership and assistance.
- My parents for their encouragement and interest.
- A special word of thanks to my husband, Wikus, children, Stefan and Riki, for your love and support.
- The financial assistance of the National Research Foundation (NRF) towards this study is hereby acknowledged. Opinions expressed and conclusions arrived at, are those of the author and are not necessarily to be attributed to the National Research Foundation.
- And the Department of Arts, Culture, Science and Technology for making the data and reports of the National Research and Technology Audit available. Opinions expressed and conclusions arrived at, are those of the author and are not necessarily to be attributed to the Department of Arts, Culture, Science and Technology.
Abstract

The use of a multi-agent learning system to analyse embedded context in qualitative data for decision-making

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A number of studies have shown that the success of knowledge discovery from data, with an intelligent data analysis tool, is dependent on the combination and integration of individual data mining techniques. The aim of this study was to determine whether an intelligent data analysis tool could successfully be used to analyse the context embedded in a real world data repository. Although the data repository contained both quantitative and qualitative measures, the study only focussed on the qualitative aspects of the data. For example, organisations were characterised in terms of the key technologies that made their products sustainable in the market rather than its market share.

The intelligent data analysis tool was based on a multi-agent learning system that consisted of learning agents or so-called learners grouped into learner teams. A learner team included data mining techniques as well as human learners. These learners interacted with one another and the environment. The interactions between the learners involved learning in a co-operative inductive learning team. This was accomplished by team members sharing their knowledge, i.e. the rules they have acquired during the learning process. The knowledge acquired by each individual learner, as well as the team’s knowledge were stored in separate knowledge bases.
The intelligent data analysis tool was evaluated against a data repository developed as part of the National Research and Technology (NRT) Audit conducted for the Department of Arts, Culture, Science and Technology of the South African Government. The results of the cooperative learner teams were verified by the active participation of a human expert, as well as against a synthesis report. This report, which was another major output of the NRT Audit, contained findings of experts that described the current state of science and technology in South Africa. Also, it outlined certain trends that were based on the data collected during the NRT Audit.

Experimental results indicated that the intelligent data analysis tool could be applied successfully to a real-world application. It was concluded that the inclusion of a human learner makes a substantial contribution to a multi-agent learning system. The intelligent data analysis tool can be successfully used by human experts to verify their findings and therefore assist them in gaining confidence in their own interpretation of the data. The results obtained from the application of the tool differed from the opinions of the human experts in some instances, indicating pre-conceived ideas that were erroneously made. The human experts indicated that their inclusion in the learning process was a valuable learning experience.
Opsomming

Die gebruik van ‘n multi-agent leerstelsel vir die analise van verskuilde konteks in kwalitatiewe data om besluitneming te ondersteun

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Verskeie studies het aangetoon dat die sukses van ‘n kennisontdekkingstrategie uit ‘n data omgewing, met ‘n intelligente data analyse werktuig, afhanklik is van die kombinasie en integrasie van individuele datumtegnieke. Die doel van hierdie studie is om te bepaal of ‘n intelligente data analyse werktuig toegepas kan word in ‘n werklike situasie om die konteks verskuil in ‘n databank te kan analyseer en sodoende die besluitnemers te ondersteun. Die databank bevat beide kwalitatiewe sowel as kwantitatiewe maatsstawwe. Hierdie studie het gekonsentreer op die kwalitatiewe aspekte. Byvoorbeeld, ‘n organisasie is beskou in terme van sleuteltegnologieë wat die firma lewensvatbaar in die mark maak, eerder as die organisasie se markaandeel.

Die intelligent data analyse werktuig is gebaseer op ‘n multi-agent leerstelsel wat bestaan uit leeragente wat in leerspanne gegroepeer is. ‘n Leerspan bestaan uit beide datumtegnieke, sowel as kundige individue, wat met mekaar en die omgewing saamwerk. Die interaksie tussen die leeragente behels koöperatiewe leer wat plaasgevind het in spanne en bekend staan as koöperatiewe induktiewe leerspanne. Dit was bewerkstellig deurdat spanlede hulle kennis, die stel reëls wat hulle gegenereer het gedurende die leerproses, met mekaar uitruil. Die kennis wat elke individuele leerder, sowel as die span as geheel ontdek het, is in aparte kennisbasisse gestoor.
Die intelligente data analise werktuig is gebruik om die databank, ontwikkel as deel van die Nasionale Navorsing en Tegnologie (NRT) Oudit van die Departement Kuns, Kultuur, Wetenskap en Tegnologie van die Suid-Afrikaanse Regering, verder te ontleed. Die resultate van die koöperatiewe inductiewe leerspanne is getoets deur die aktiewe deelname van 'n kenner in die gebied, sowel as teen die sintese verslag wat nog 'n uitset van die NRT Oudit was. Hierdie verslag bevat die bevindinge van gebiedskenners wat die huidige stand van die wetenskap en tegnologie in SA beskryf, tesame met sekere tendense bepaal vanaf die data wat gedurende die Audit versamel is.

Die resultate toon dat die intelligente data analise werktuig wel suksesvol in 'n werklike situasie toegepas kan word. In hierdie toepassing het die menslike leerder 'n beduidende bydrae gemaak tot die multi-agent leerstelsel. Die strategie kan gebruik word om die gevolgtrekkings van die kenners betrokke in die analise te bevestig en hulle sodoende te help om vertroue in hulle eie interpretasie van die data op te bou. Die strategie het ook soms verskil van die menings van die betrokke kenners en het daardur foutiewe aannames uitgewys, wat weer vir die individue 'n waardevolle leerervaring was.
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