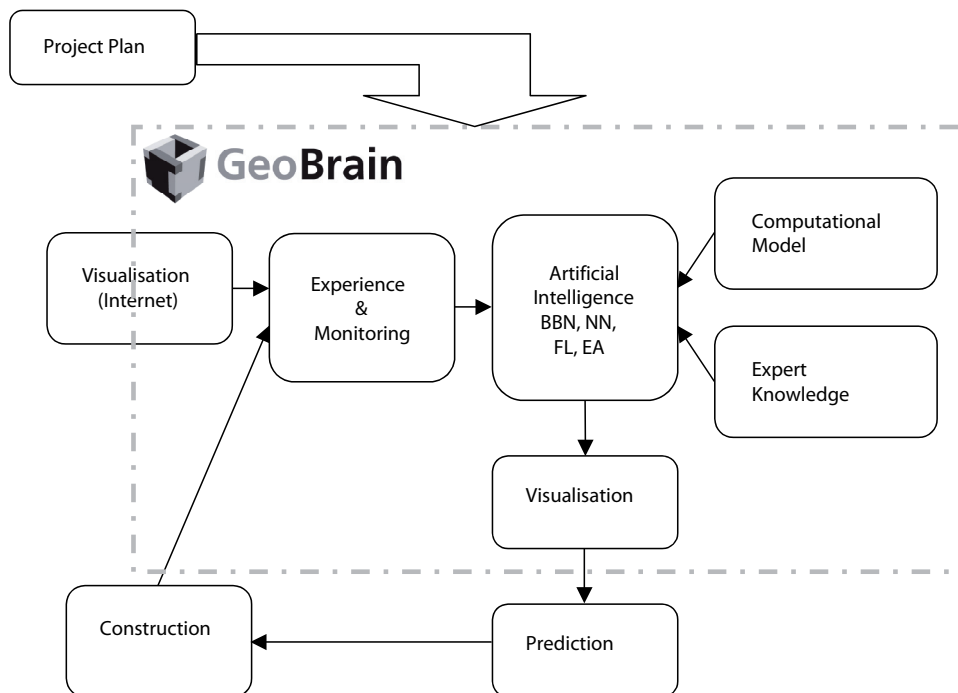# Reducing the risks in geotechnical engineering using artificial intelligence techniques

SUMMARY

written by:

A. M. J. Mens
GeoDelft

P.O. Box 69, 2600 AB Delft
Tel: +3115 - 269 35 89
a.m.j.mens@geodelft.nll

Delft Cluster project: 01.30 New perspectives for foundation

THE REASON FOR THE RESEARCH
Worldwide, ground-related uncertainty and risk dominate often in geotechnical engineering. Until now technological investigations and developments in engineering geology focused primarily on (computational) modelling and extending knowledge about underground behaviour. Nevertheless the results are limited, according to the sky-high costs related to failures in construction. Apparently traditional modelling is not sufficient anymore. The big profit for the upcoming decennia may be found in merging (field) experience and theory.
GeoBrain, being a unique new facility within the technological institute GeoDelft, started a few years ago combining hard data (experiences as well as measurements) with traditional models and expert knowledge. Using artificial intelligent techniques GeoBrain is able to make well defined predictions about soil behaviour in relation with the mentioned knowledge. In some branches of Civil Engineering Artificial Intelligence has found a wide application, for example in hydrology; especially Bayesian Networks and Artificial Neural Networks combined with Fuzzy Logic and Evolutionary Algorithms seem to be quite promising.

THE PLAN OF THE PROJECT
At this moment insufficient knowledge is available about appropriate applications concerning the wide range of possible implementations of hybrid systems in geo-engineering. Therefore, first, available scientific literature on AI and risk analysis will be scanned with respect to implementation risks in foundation engineering. Emphasising hybrid methods already developed in hydraulics and hydrology, the objective is to develop new prediction tools. The already developed GeoBrain predicting tool, based on experts' knowledge will be used as a case study to validate these new techniques. Two questions arise in this context. 1) Is a Bayesian Belief Network the correct method to provide the GeoBrain prediction-model with the ability to learn from the GeoBrain experience-database and from expert knowledge? 2) Is a Bayesian Belief Network suitable for catching expert-knowledge and to improve predictability through (field) experiences?

THE RESULTS OF THE PROJECT
Emphasising hybrid methods already developed in hydraulics and hydrology, the objective is to develop new prediction tools. The already developed GeoBrain predicting tool, based on experts' knowledge will be used as a case study to validate these new techniques.