Network based prediction at banks

Executive summary

All banks are interested in better prediction of events such as credit default, churn or fraudulent behavior. The first goal was a feasibility study of network based prediction of such events. After that we worked out a complete system that effectively learns and computes probabilities of these events.

Challenge overview

The application was partly driven by the Basel II and III accords that require risk management considering network effects. It was also a factor that the traditional decision support/data mining methods have reached their maximal performance. In the recent years there was a tremendous development in the theory of networks (or Small World graphs) that paved the way to work out a solution. However, it was clear for the first moment that even the OTP Bank is lacking the resources to undertake a project of this depth, since it involved experimenting with graphs arising from transaction data, creating theories and software to handle infection problems on large scale.

Implementation of the initiative

The initial project was financed by OTP Bank's R&D budget, later it were financed by other resources of the Bank. From OTP side T.Toth was the manager and A.Csernenszky the expert who took part in the project. From the vendor side (Sixtep Ltd.) Gyula Kovacs was who lead the technical implementation. At Sixtep M.Kresz and A.Pluhar lead the IT developers namely A.Bota, B.Kerekes.

After examining the legal possibilities the Bank has started to build database from B2B transactions at the end of 2008. The first pilot project was in the first half of 2009, in the second half of the year there were a successful implementation of two reports: An attrition- and a bankruptcy-forecasting model for companies. Both are taking consider networks effects) Since then there are continuous developments: such as optimising infection model (relevancy tests, modelling on edges), monitoring changes in 'communities', using database about Hungarian companies etc.

The problem

The problem has three main parts. First of all, one has to draw a graph from data stored at the bank's data warehouse. Then a model that adds the network effect to the individual event (i.e. transforms the a priori probabilities to a posteriori ones) has to be built and computed. This part was handled by generalized infection algorithms. Thirdly, a learning mechanism was needed that to explore how the infection probabilities depend on available costumer data, the transaction graph etc.

Results and achievements

Using network models (like parametrized Independent Cascade model), we found such segments of the Corporate portfolio where the expected bankruptcy is 3-4 and even 10 to 12 times of the average bankruptcy rate. By using a different network model - we have also found groups (i.e communities) of clients who were likely to leave the Bank. Incorporating all these predictions, monthly reports were being built for supporting the job of Account Managers. By the improved monitoring system the bank significantly reduced the loss on bankruptcies and decreased its churn rates.

Bankruptcy forecasting report:

▷ Corporate companies with loan/credit
⇒ Marking bankrupted clients
⇒ Using infection model(s)
⟹ Finding exposed/vulnerable clients

Churn report:

▷ Corporate companies with account in the Bank
⇒ Marking inactive clients
⇒ Using (network) community detection
⟹ Finding groups of clients with high churn probability

Lessons learned and replicability

Many corporal data explicitly or implicitly carries exploitable graph structure. Infection methods can be very useful to predict to spread of events or estimate unknown function values. It is possible to design effective learning methods to acquire the crucial parameters to such models. To carry out the whole process, one need a sophisticated and powerful software. We got the experience of mining the networks, build the infection model, to fine tune them, and also developed software that can be used with a variety of conditions.

Contacts, References

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References:

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