DANMARKS NATIONALBANK

Text-based machine learning as a tool for distress modelling

Can texts in annual reports predict whether a firm will enter into distress?

Normally the numerical financial data of a firm is scrutinised when the soundness of the firm is assessed. But texts in the annual reports may also contain important information that can help to predict distress events.

Managements' statements and auditors' reports in annual reports may contain valuable information if these texts are subjected to machine learning methods. That is the conclusion in an analysis and a working paper published by Danmarks Nationalbank.

Machine learning could also be described as automated learning. It is a technology whereby large volumes of historical data train a computer to find rules and relationships. This means that the computer learns to recognise patterns on the basis of data and examples.

Machine learning is not a new invention, but as computers have become more powerful and the methods more advanced, it has become more useful. In text analysis, not only the meanings of the individual words are considered, but also their context.

Text in accounts may contain information about risk of entering into distress

"It is our assessment that there are no realistic options for obtaining funding and we therefore make the caveat that the statement has been submitted on the basis of continued operations.

"The firm has not yet received acknowledgement from the involved bank, and on that basis we can not reach a conclusion regarding the firm's ability to continue operation.

Source: Examples from auditors' reports.

Most firms' financial statements contain an "auditors' report" stating the auditors' opinion after they have examined the financial statements. For example, the auditors may say: "It is our assessment that there are no realistic options for obtaining funding and we therefore make the caveat that the statement has been submitted on the basis of continued operations."

In this case, the auditors take a negative view and question the firm's ability to continue its operations. This is important information which cannot necessarily be derived from the numerical financial data. In that way, a model to predict whether a firm will enter into distress can be improved substantially by including such texts in the overall assessment of the soundness of a firm.

The analysis shows that the possibility of predicting distress is improved – especially if a text-based analysis of auditors' reports is included. The reason may be that an auditors' report is more objective, while the management of a firm may tend to focus on the areas where the firm is performing well.

Without knowing it, many people benefit from machine learning on a day-to-day basis. One example is the Google search engine, which uses machine learning to find relevant answers to searches. Another example is spam filters in email programmes. They learn to recognise patterns from millions of emails and hence to assess the risk linked to the emails arriving in the inbox.

One of Danmarks Nationalbank's key tasks is to contribute to the stability of the financial system. Distressed firms may have an impact on bank losses and earnings and ultimately on financial stability. For this reason, and others, Danmarks Nationalbank works with machine learning.

Find the analysis (*link*) and the working paper (*link*) on machine learning at Danmarks Nationalbank's website.

ABOUT NEWS

News are news articles based on analyses, working papers or other longer texts from Danmarks Nationalbank. News primarily address journalists, politicians, government officials, specialists and others who want to be updated on current topics.

The news article consists of a Danish and an English version. In case of doubt regarding the correctness of the translation the Danish version is considered to be binding.

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