This Italian case study pursues the goal of developing a commercial firms insolvency prediction model. In compliance with the Basel II Accords, its major objective is an estimation of the probability of default (PD) over a certain time horizon, typically one year. The model predicts the firm that are going to fail within one year, using deep fully connected layers and CNNs.

Data

The present research utilized the company's AIGA database - Bureau Van Dijk, a Moody's Group company. After preprocessing, 14,966 Italian micro and small firms have been selected: 13,846 active and 1,120 bankrupted.

Features

The selected variables (inputs), as are BB. They are the most meaningful in terms of capacity of pointing out the critical issues related to a firm financial and economic equilibrium in the long term. According to the literature, the chosen variables are closely related to gauge liquidity, profitability, financial solvency and operating performances, namely, the liquidity ratios, EBITDA, ROE, ROI and, among others, data ratios. Refer to Table 2

Three Models

1) The Baseline: a simple sequential fully connected model has been used as benchmark. The shape of the input layer is (88 x 19,883).

2) The Deep Sequential Model: this model has the input shape as the Baseline. The architecture is much more complex: 15 input layer with shape (BB, 19,883), 17 inner layers, 512 neurons each and 1 output layer. This model totals 262,559 parameters of each of the layers from to 17 and 45,568 parameters for the inner layer 1. Adding 513 parameters of the output layer, the final number of trainable parameters is 4,248,577.

3) The CNN Model: To apply the CNN it is necessary to modify the data structure to obtain a 3D matrix. In fact, these expect that each unit corresponds to a matrix. Actually, the data are obtained observing two years, so we have in total 88 variables, 44 for time -1 and 44 variables for time -2. So, each row of the original training set (BB, 19,883) has been reshaped in an array of dimensions (7, 7, 2) for 1983 samples.

Discussion

In this paper, the large amount of data for small and medium-sized Italian companies collected from financial and income statements have been processed, applying two different Neural Network architectures: a deep sequential model and (ii) a Convolutional architecture, using a simple as a very simple sequential one as a baseline. The results obtained show that all models, including the baseline, achieve good results, probably due to the good quality of the data. The model with the best performances was the Sequential Architecture which reached the highest AUC value, 0.90 and the highest sensibility 0.82/5. The CNN Architecture showed the best specificity (number of True Positives capped).

The Sequential model captures 270 out 335 True positives.

References