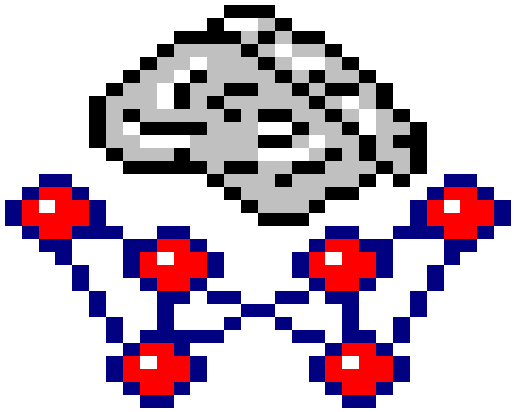


# Neural Credit Assistant

## Frequently Asked Questions:

### *How do you use the NCA in an investment process?*

For the portfolio manager considering the purchase of a corporate bond for the portfolio there is a vast spectrum of candidates from which to select. Even after narrowing the spectrum by specifying the maturity ranges, the yields and the ratings of the bonds the candidates are extensive. A naive approach would take the remaining candidates and rank them by their ratings and then by their spreads to provide a rank ordering of the attractiveness of the investments. This naive approach results in the manager frequently purchasing those bonds that are trading wide relative to their "ratings" and ignoring other bonds that are trading narrower than their "ratings". For those bonds trading wider than their ratings warrant, the question remains of whether the spread reflects the risk of the bonds being downgraded.

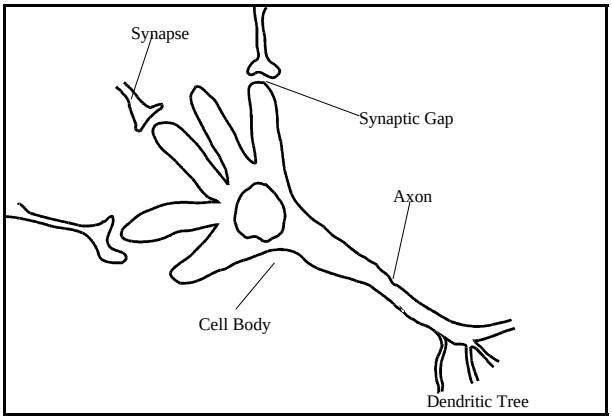
For example a weak "BBB- " trading 15 basis points wider than the average "BBB-" all other things being equal would be an attractive investment. But if the wider trading bond has a significantly higher chance of being downgraded to high yield, then the 15 basis points may not fully reflect the risk and turn out to be a poor performing investment. The opposite case is also true when the manager neglects the bonds trading narrower than the average ratings results in poor performance in those cases when the narrower spread didn't reflect the full narrowing that will occur from upgrades.

Certainly no investment manager uses the naive approach to selecting investments, but what separates the average investment manger from the top performers are the tools and techniques that they use to identify a rich bond from a cheap bond. The Neural Credit Assistant can play a critical role in the identification. The Neural Credit Assistant provides a consistent quantitative score to measure the credit trends of each company and across companies. It allows the portfolio manager/analyst to identify credits that have significantly improved/or deteriorated before the rating agencies and the market has taken action. The NCA tends to be a leading indicator of the trend of the credit as early as two years prior to the ultimate rating change. Over the last four years the system has correctly identified 74% of the upgrades and 65% of the downgrades. This predictive capability combined with a manager's investment knowledge and experience provides a significant advantage in the investment process.

### *What is a to Neural Net?*

Neural networks are the result of scientists and the engineers attempting to exploit the process used by the most complex computing device known to man - the human brain. The brain's powerful thinking, remembering, and problem-solving capabilities result from its ability to use a complex web of tens of billions of neurons. These neurons allow the brain to process, analyze and remember the massive amount of data that it is exposed to every day through the specialization of the neurons. The specialization allows the brain to

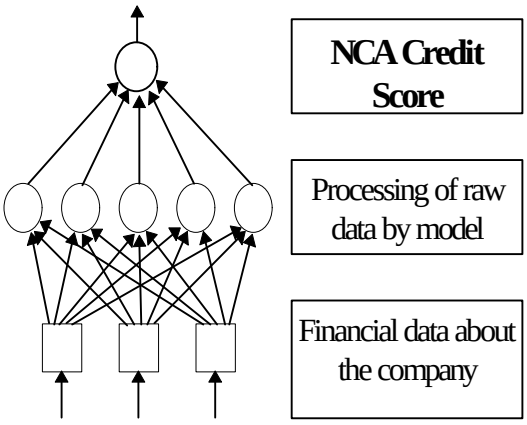
break complex problems into small parts and allow the neuron to concentrate on their individual part of the problem and then share their answer with the rest of the brain through the interconnections. An individual biological neuron has fairly simple computational ability. By itself, an individual neuron is not very interesting and has limited computation ability. The interesting computational properties emerge when neurons are combined together in various ways. A simplified diagram of one type of neuron is shown below:




## *What is an artificial neural net?*

Artificial neural nets exploit the concept of densely connected networks of simple processing units for practical computational use. Neural nets have been successfully developed in areas of credit card fraud detection, stock market timing systems, consumer credit risk analysis, bankruptcy prediction, and military weapons systems. Neural computing in general, builds models based on historical data. Neural networks are applicable in any situation where there is an unknown relationship between a set of input factors and an outcome, and for which a representative set of historical examples of this problem are available. The objective of building a model is to find a formula or program that facilitates predicting the outcome from the input factors.

The Neural Credit Assistant is a good example of how a neural network operates. The goal of the model is to develop an algorithm, or process by which to determine the senior rating of a company through an analysis of financial ratios derived from the company's financial statements and senior rating assigned by rating agencies. Our training examples are all contained in a proprietary database of the financial information and senior debt ratings. A company typically has multiple examples within the database, one example for each four quarters of data. The companies selected for the system were those with ratings based upon their own financial position and not dependent upon credit support from a parent company or other entities. The financial data for each example includes historical data going back three to five years from the balance sheets, income statements and the equity markets. The bond rating used for each example was the rating two quarters following the end of the period. We used the rating two quarters after the end of the period to adjust for the time lag between the end of a period and when the financial information for that period is actually reported. If the rating agencies are going to adjust the rating based on the financial results, then there will be a lag between the end of the period and a rating change. The database is continuously being added to as new companies are being rated and as new financial statements are being released. The Neural Credit Assistant currently uses over 31.000 examples from over 2,800 companies in its learning process. Each month the Neural Credit Assistant is retrained to take into account new examples from the current companies, rating changes and examples from new companies.

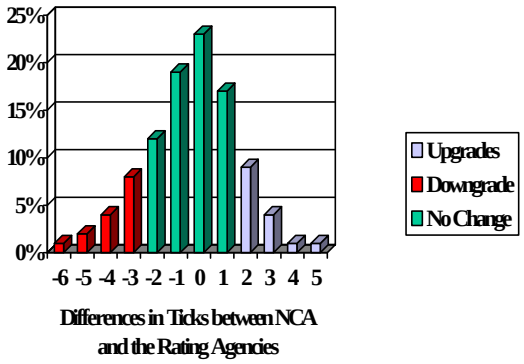


## *How do you train the Neural Credit Assistant?*

The system is not programmed with any preexisting rules or structure; it actually learns through experience and trial and error. The neural system uses a training procedure through which it is repeatedly shown examples of how the various rating agencies have rated the senior debt of companies and the financial ratios associated with those companies. The model will start out assigning weights to each of the inputs into the model and for each example calculate how closely the resulting rating was to the desired rating and then sum these differences to arrive at a score for this set of weightings. This process will be repeated interactively to adjust the weightings to minimize the errors of the model. Based on these examples, the system "learns" the nature of the relationship between the financial ratios and the ratings that have been assigned. Each month the system is retrained by including not only the examples that were available to the system last month, but also the new examples available from companis releasing new financial data, new companies being rated, and companies being upgraded and downgraded. This allows the system to continuously learn and improve.

## I have credit analsysts why do I need the Neural Credit Assistant?

How would you like to have an assistant who has years of experience in analyzing the financials of thousands of companies over many cycles of the economy, never forgets a thing, is constantly learning and never takes the day off? Having the Neural Credit Assistant as a tool in your credit analysis process gives you that assistant. The assistant 's specialty is in understanding how to use standard financial analysis ratios and proprietary ratios to analyze the financial condition of a company. The Neural Credit Assistant is only concerned with the numbers and leaves the subjective factors for you and your analysts to take into account in understanding a company. The graph below is a good illustration of how to use a good team of credit analysts and the Neural Credit Assistant effectively. The red columns represent companies in a portfolio that the NCA would suggest have a higher likelihood of being downgraded, while the blue columns represent those companies with the highest likelihood of an upgrade The red and blue companies are roughly 30% of the companies that the analysts should concentrate their efforts on for the greatest impact, rather than diluting their efforts on the remaining 70% of the companies where the companies' financial condition hasn't changed.




While most people would agree that a credit process based solely on ratio analysis is short sighted, most would agree that a process without objectivity and consistency is equally doomed to problems. The Neural Credit Assistant provides an objective and consistent credit rating tool across time and companies to aid in the evaluation of corporate credits. It should be seen as an additional tool to be used by in credit analysis and not as a replacement for an analyst's subjective judgment.

## *Additional Coverage*

One of the benefits of the NCA's credit classification ability is that it provides an objective tool to analyze companies regardless of whether or not a major rating agency has rated the company. With the NCA investors needing to compare the credit quality of companies no longer need to limit their analysis to publicly rated companies. We currently maintain a database of an additional 7,000 companies that we can provide comparable NCA rating for review. We do offer an additional product that provides investors with the ability to rate companies not currently covered. If you have an interest in a specific company not currently reported in the Neural Credit Assistant or the rating product please contract me at the e-mail or phone number below.

## *How often is the data updated?*

The data for the NCA is updated on a weekly basis to reflect companies reporting new financials, new companies and rating changes. To get the latest data update go to the Update Section of the NCA and download the latest data. Download that file to your computer and then unzip it into your NCA subdirectory. As the NCA is loading it will display the date that your data was last updated.

## Rating Changes

Over the last four years their were 941 companies covered by the Neural Credit Assistant whose rating were changed by the rating agencies based upon changes in their financial condition and not by mergers/acquistions or other similar events.

## NCA Prediction Accuracy 6/96 - 10/00

| Rating Agency Action | NCA Predicted Downgrade | NCA Predicted No Change | NCA Predicted Upgrade |
|---|---|---|---|
| **Downgraded** | 64% | 16% | 20% |
| **Upgraded** | 11% | 14% | 75% |

## *How does the Neural Credit Score equate to a rating agency rating?*

The Neural Credit Assistant's credit score represents an objective opinion of a company's long term senior debt credit rating, or "Corporate Credit Rating". The table below gives you the translation between the NCA score and the typical rating agency rating.

| NCA Score | S&P | Moody's |
|---|---|---|
| 0.0001 | D | D |
| 50 | CCC− | Caa3 |
| 100 | CCC | Caa2 |
| 150 | CCC+ | Caa1 |
| 200 | B− | B3 |
| 250 | B | B2 |
| 300 | B+ | B1 |
| 350 | BB− | Ba3 |
| 400 | BB | Ba2 |
| 450 | BB+ | Ba1 |
| 500 | BBB− | Baa3 |
| 550 | BBB | Baa2 |
| 600 | BBB+ | Baa1 |
| 650 | A− | A3 |
| 700 | A | A2 |
| 750 | A+ | A1 |
| 800 | AA− | Aa3 |
| 850 | AA | Aa2 |
| 900 | AA+ | Aa1 |
| 950 | AAA | Aaa |

If you have questions or comments please contact:
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# NCA Tracking Test

| Date | Company | Rating Agency | Old Rating Agency Rating | New Rating Agency Rating | NCA Rating | Hit or Miss |
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