Credit Scoring with Enterprise Miner

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Agenda

- Credit Scoring Introduction
- Building Credit Risk Models
- Scorecards and Beyond
Credit Scoring Introduction

- Retail Banking
  - Consumer Credit
    - long term: mortgages
    - short term: car loans etc.
  - Small Business Loans
- Investment Banking
  - Corporate Finance
  - Credit Trading

The SAS Solution for Credit Scoring

Risk Dimensions
Credit Scoring Introduction

- Profitability big issue in retail banking
- CRM strategy needed
- Acquisition and Cross-selling
- 2 questions
  - would the customer be interested in a loan
  - would the customer be profitable/ pay back
Credit Scoring Introduction

- Different credit products
  - Fixed term loans
  - Revolving credit
    - Credit cards
    - Checking account overdraw
- What is a ‘good’ customer
  - Revolving: a good customer doesn’t pay back immediately
Credit Scoring Introduction

- Response Scoring
- Application Scoring
  - predict ‘good/bad’ before contract starts
- Behavioral Scoring
  - predict ‘good/bad’ during contract runs
- Collection Scoring
- Audit Scoring
Credit Scoring Introduction

- Application scoring
  - Fixed term loans
  - ‘good/bad’=payback yes/no
  - Only uses information available when the customer applies and before
- Prospecting
- Acceptance
Credit Scoring Introduction

- Behavioral scoring
  - Holistic view, not focused on one product
  - ‘good/bad’=‘profitable yes/no’
  - Monitoring: see insolvency coming, especially in the small business sector
  - Related to segmentation and customer lifetime value analyses
  - Relevant for prospecting and retention
A model is

- a set of rules or an equation that relates customer attributes to a good/bad score

If $\text{debt/income} < 0.5$ and $\# \text{arrears} < 2$ then $\text{score} = 0.2$

or

$\text{score} = -0.8*\text{debt/income} + 0.5*(\# \text{arrears}<2)$

or

$\text{score} = -0.8*\text{woe}_{(\text{debt/income} < 0.5)} + 0.5*\text{woe}_{(\# \text{arrears}<2)}$
Building Credit Risk Models

- Stages in credit scoring
  - Define the goal
  - Prepare the example data
  - Build the model
  - Apply the model (score the customer)
  - Act on the scores (campaign, accept, monitor)
  - Monitor the quality of predictions
Available information

- New customers, before they apply
  - demographics
- New customers, when they apply:
  - demographics, application form and credit bureau
- Existing customers, before they apply:
  - demographics, previous applications and previous behavior
- Existing customers, when they apply:
  - demographics, previous applications, previous behavior, current application and credit bureau
Building Credit Risk Models

Various Transactional Systems

Customer History
Arrears History
Balance & Transaction History
Application Forms
Web Visit History
Contact Events
External: demographics
External: credit bureau

SAS Warehouse Administrator

Train & Validation data sets
Test data sets
Score data set
SAS score code
Predicted values

if ... then ...

0.8

0
1
0

Enterprise Miner
Warehouse Administrator™
Enterprise Miner™
Building Credit Risk Models

- Prospecting
  - List of prospects (also Response Scoring)
  - Profiles of good prospects

- Acceptance
  - Profit by cutoff-score and list of accepts
  - Override reports
  - Model quality and population stability monitoring

- Credit Performance Monitoring:
  - List of alarms
  - Exposure Indicator (Dashboard)
Prospecting & Monitoring (middle office)
- Emphasis is on accuracy of the predictions
- Batch scoring

Acceptance (middle office or front office)
- Immediate or almost immediate decisions
- Easy explanation of the decision and a decision process that appears transparent and fair to the applicant
- When the acceptance decision is to be done on the spot and in front of the customer traditionally a paper scorecard is used
Scorecards and Beyond

- Scorecards
  - Paper sheet application forms
  - Each answer in the application form is worth a certain amount of points
  - When the final score stays below a certain threshold the application is accepted, otherwise denied or referred
Scorecards and Beyond

<table>
<thead>
<tr>
<th>Alter</th>
<th>Pkt.</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 bis 20 Jahre</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>21 bis 25 Jahre</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>26 bis 30 Jahre</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>31 bis 35 Jahre</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>36 bis 50 Jahre</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>51 bis 60 Jahre</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Ober 60 Jahre</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Beruf</th>
<th>Pkt.</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicht berufstätig</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Älter Angestellter Dienst</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Beamte</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Facharbeiter, Angestellte</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Hilfsarbeiter, Azubi</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Rentner</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Geschäftigt bei</th>
<th>Pkt.</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Öffentl. Dienst</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Industrie, Handel, Gewerbe, Dienst.</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Rentner, Pensionär</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Beschäftigungsduer beim jetzoer Arbeitgeber</th>
<th>Pkt.</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>aktuell bis 1 Jahr</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>aktuell bis 2 Jahre</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>aktuell bis 3 Jahre</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>aktuell bis 5 Jahre</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>aktuell über 5 Jahre</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Rentner, Pensionär</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Familienstand</th>
<th>Pkt.</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>lebt nicht wie eine Lebensgemeinschaft</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>weitere Immobilien Vermögen</th>
<th>Pkt.</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haus, Grundstilz, ETW</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Kapitaldienstfähigkeit</th>
<th>Pkt.</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>(verfügbares Einkommen wird zu X% durch Kapitaldienst aufgezahlt)</td>
<td>Rate x 100</td>
<td></td>
</tr>
<tr>
<td>verfügbares Einkommen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bis 50%</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>51 - 60%</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>61 - 100%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ober 100%</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Kreditverleihung der letzten 6 Monate</th>
<th>Pkt.</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>innerhalb Limit tgl. auf</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tatsachenbuch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oberziehungen beantragt</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>anstehende Uberziehungen</td>
<td>1,16</td>
<td></td>
</tr>
<tr>
<td>Uberziehungen mit Retouren</td>
<td>1,20</td>
<td></td>
</tr>
<tr>
<td>Mangels Deckung</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Kredite bei Volksbank</th>
<th>Pkt.</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>keine Vorkredit</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Vorkredit ordnungsgem. bedingt (bemitt durchlaufren)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>oder der bestehender Kredit wird ordnungsgem. bedingt (Klien laufen auf KK nicht auf)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Mahnung war erforderlich</td>
<td>1,10</td>
<td></td>
</tr>
<tr>
<td>verspätete Restezahlungen</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Scorecards and Beyond

• Promise
  • Decisions can be made and ‘explained’ by branch office staff on the spot, only using a piece of paper

• Limitations
  • Accuracy: each answer is scored independently of the others
  • Many questions to answer
  • Electronic equipment is still needed to look up answers: previous loans, overdraws, turnover, credit bureau
  • Cumbersome to update
Scorecards and Beyond

- Traditional scorecards can be calculated and updated with Enterprise Miner
- A more flexible approach uses decision trees to
  - detect interactions
  - facilitate integration of business rules
  - reduce the number of questions to ask
- Accuracy of different models can be predicted and compared within Enterprise Miner
- Scoring can be done anywhere, for example using Internet or mobile phone technology.
Scorecards and Beyond

Debt/Income: _

- na
- <.6
- >.6

0.9
0.2
0.6
Scorecards and Beyond

Debt/Income: 0.57

na
0.9
<.6
0.2
>.6
0.6
Scorecards and Beyond

Debt/Income: 0.57

<table>
<thead>
<tr>
<th># Arrears: _</th>
<th>0</th>
<th>1-2</th>
<th>&gt; 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>0.3</td>
<td>0.6</td>
<td></td>
</tr>
</tbody>
</table>

na | <.6 | >.6 | 0.9 | 0.2 | 0.6 |
Debt/Income: 0.57

# Arrears: 1

Final Score: 0.3
Cutoff Score: 0.5

Recommendation: **accept** application
## Debt/Income: 0.72

<table>
<thead>
<tr>
<th>Weight</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>na</td>
<td>0.9</td>
</tr>
<tr>
<td>0.2</td>
<td>0.6</td>
</tr>
<tr>
<td>&gt; 0.6</td>
<td>0.3</td>
</tr>
</tbody>
</table>

## Security/Debt:

<table>
<thead>
<tr>
<th>Weight</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>0.7</td>
</tr>
<tr>
<td>0.6</td>
<td>0.3</td>
</tr>
</tbody>
</table>
Scorecards and Beyond

Debt/Income: 0.72
- na
- 0.9
- <.6
- >.6

Security/Debt: 0.8
- 0-.2
- 0.2
- .2-.7
- >.7

Final Score: 0.3
Cutoff Score: 0.5
Recommendation: accept application
The SAS Solution for Credit Scoring

- A Comprehensive Package of
  - Software
    - Warehouse Administrator
    - Enterprise Miner
    - Scalable Performance Data Server
    - Customized Reporting
  - and Services
    - Rapid Results Credit Scoring
    - Defined Delivery Credit Scoring
    - Full CRM Implementation
Mainly Credit Scoring
- SACCEF (Caisse d’Epargne), France
- Compass, Italy
- Cofinoga, France
- PSA, France

Mainly Cross-selling (Credit Products)
- CGD, Portugal