

SmileX

An ActiveX Decision-Analytic Reasoning Engine and Its Application to Evaluation of Credit Applicants

Carl Thijssen



Knowledge Based Systems Group



Decision Systems Laboratory

Contents

- Organisation
- Probabilistic Reasoning
- SmileX
- Creditworthiness
- Demonstration
- Conclusions

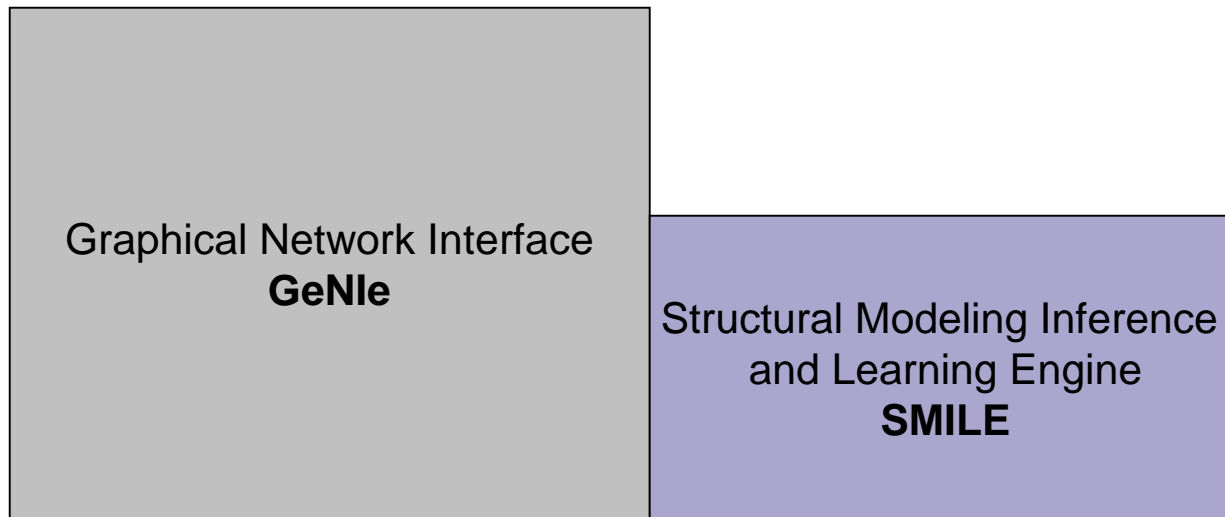
Contents

- Organisation
 - GeNIe and SMILE
- Probabilistic Reasoning
 - Bayesian Networks
 - Influence Diagrams
- SmileX
 - Requirements
 - (Rewriting or Wrapping?)
 - Client/Server Schemes
 - ActiveX
 - Applications
- Creditworthiness
 - Problem Description
 - Approaches
 - The Six C's
 - Bayesian Model
 - Acquiring the Numbers
 - Applications
- Demonstration
- Conclusions

Organisation

- TU Delft
 - Knowledge Based Systems Group
- University of Pittsburgh
 - Decision Systems Laboratory
 - GeNIe and SMILE

GeNle and SMILE



User-interface

C++ Library

Probabilistic Reasoning

- Bayesian Networks
 - Nodes
 - Causal Relations
 - Inference
- Influence Diagrams
 - Temporal Relations
 - Values

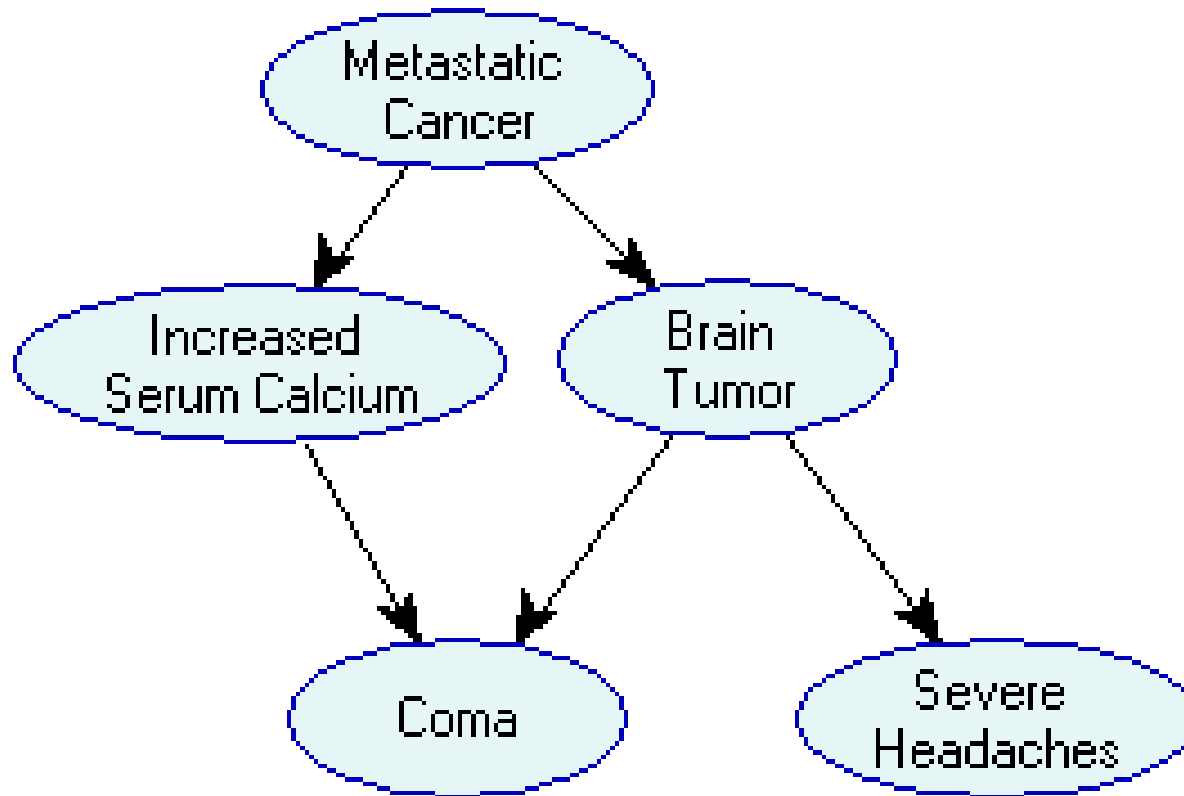
Bayes Theorem

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)}$$

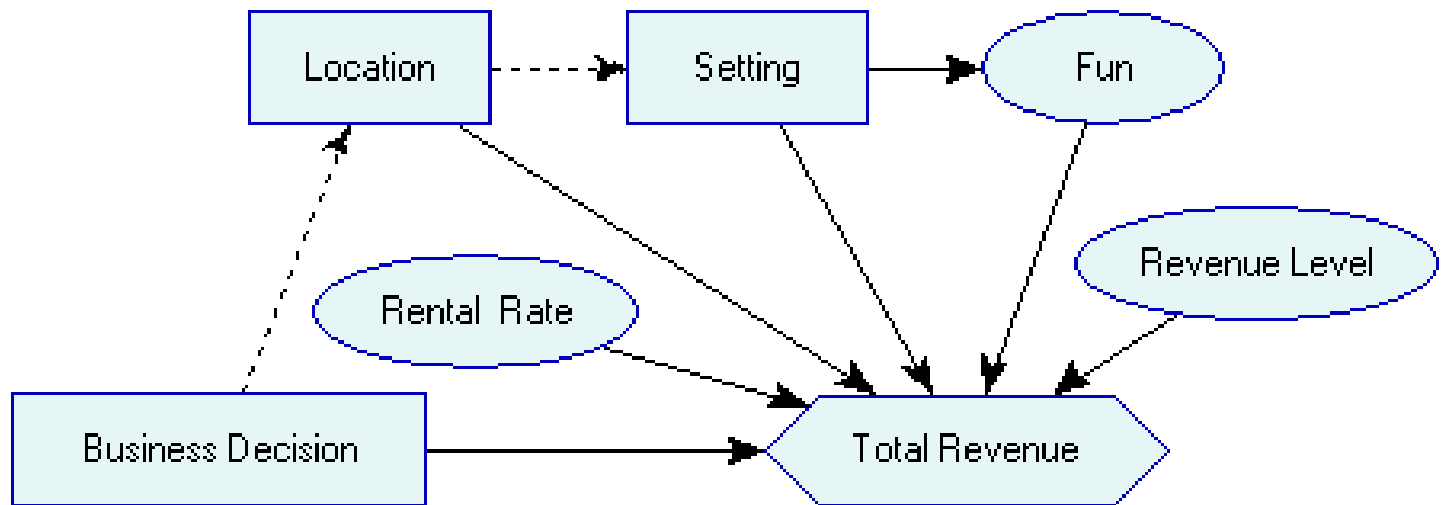
Of:

$$P(A|B) = P(B|A) * \frac{P(A)}{P(B)}$$

Bayesian Network



Influence Diagram



SmileX

- Requirements
- Rewriting or Wrapping?
- Client-Server Schemes
- ActiveX
- Applications

SmileX - Requirements

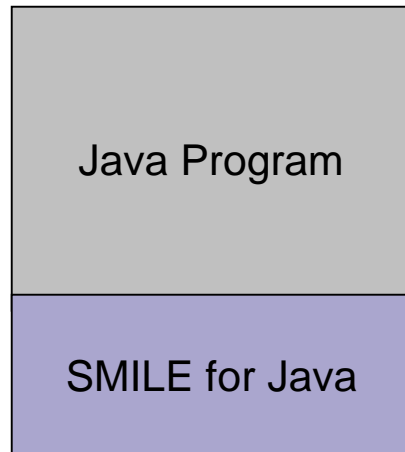
- Making AI Algorithms of SMILE accessible for non-C++ programmers
- Enable web-developers to use AI in their Web-applications
- Creating an Easy-access version of SMILE

SmileX - Rewriting or Wrapping?

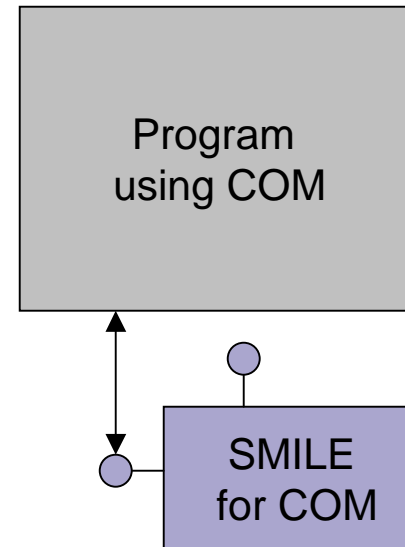
- Rewriting
 - Java
 - Component Object Model (COM)
- Wrapping
 - Java Native Interface (JNI)
 - ActiveX

Rewriting

Java

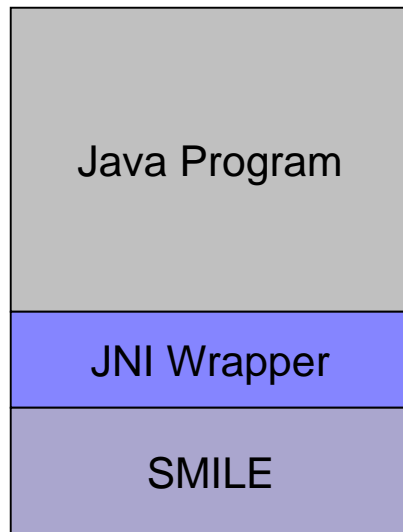


COM

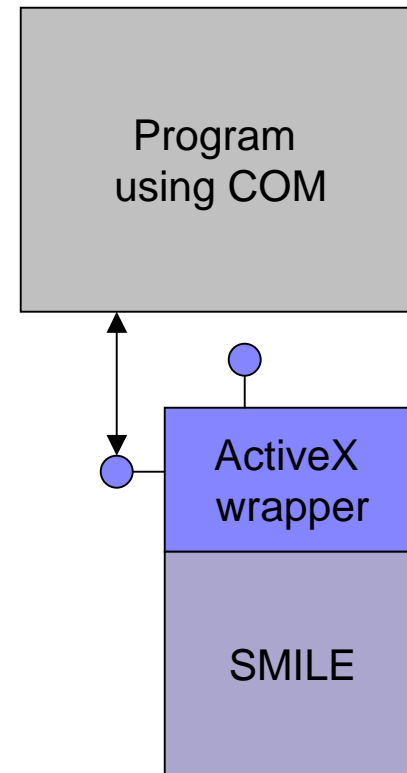


Wrapping

Java Native Interface



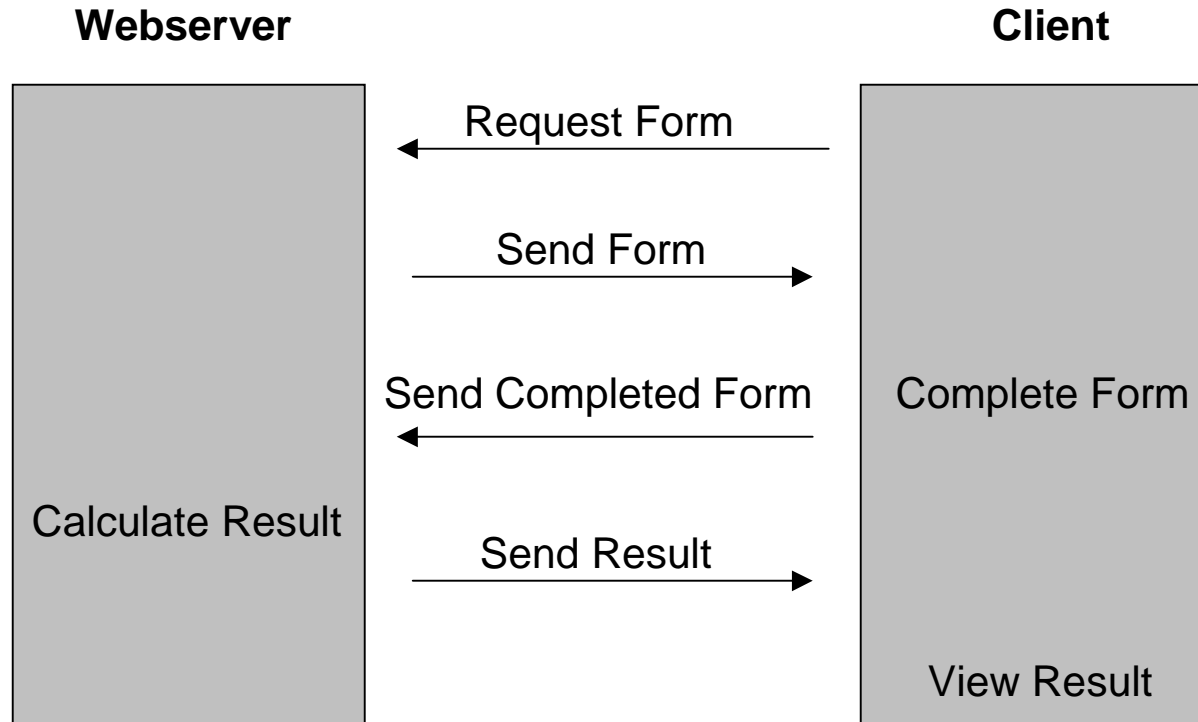
ActiveX



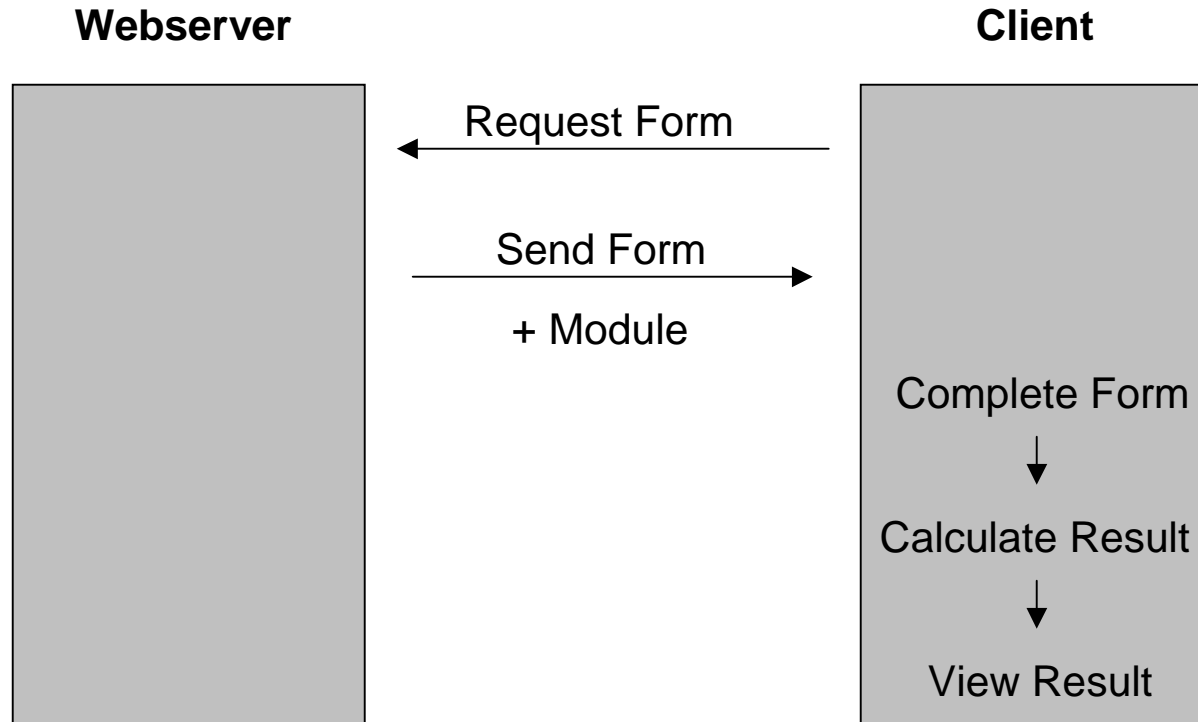
SmileX - Client/Server Schemes

- Classic Approach
Algorithms Run on Server
- ActiveX/JNI model
Algorithms Run on Client

Classic Approach



JNI/ActiveX Approach



SmileX - ActiveX

- ActiveX as an Extension to COM
- Advantages
 - Programming Environments
 - Scripting
- Disadvantage
 - Platform Dependent, tied to Microsoft Products

SmileX - Applications

- Hazardous Materials (Web)
- Lawfirm (Visual Basic)
- Credit Evaluation (Web + Excel)

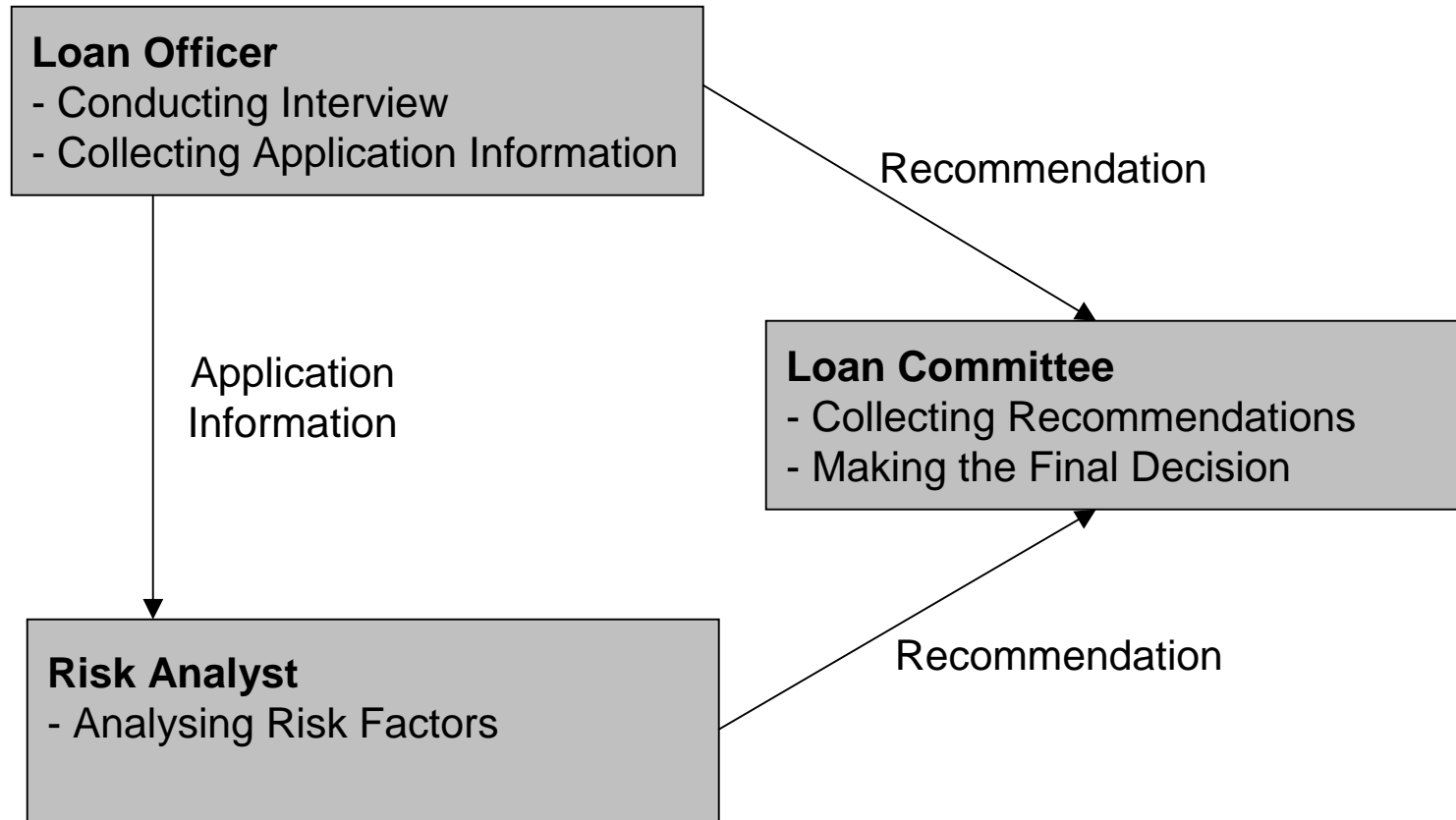
Creditworthiness

- Problem description
- Approaches
- The Six C's
- Bayesian Model
- Acquiring the Numbers
- Applications

Credit - Problem Description

- Environment
- Objective : Making Profit
- Decision : Grant or Deny Loan
- Decision-makers

Decision Makers



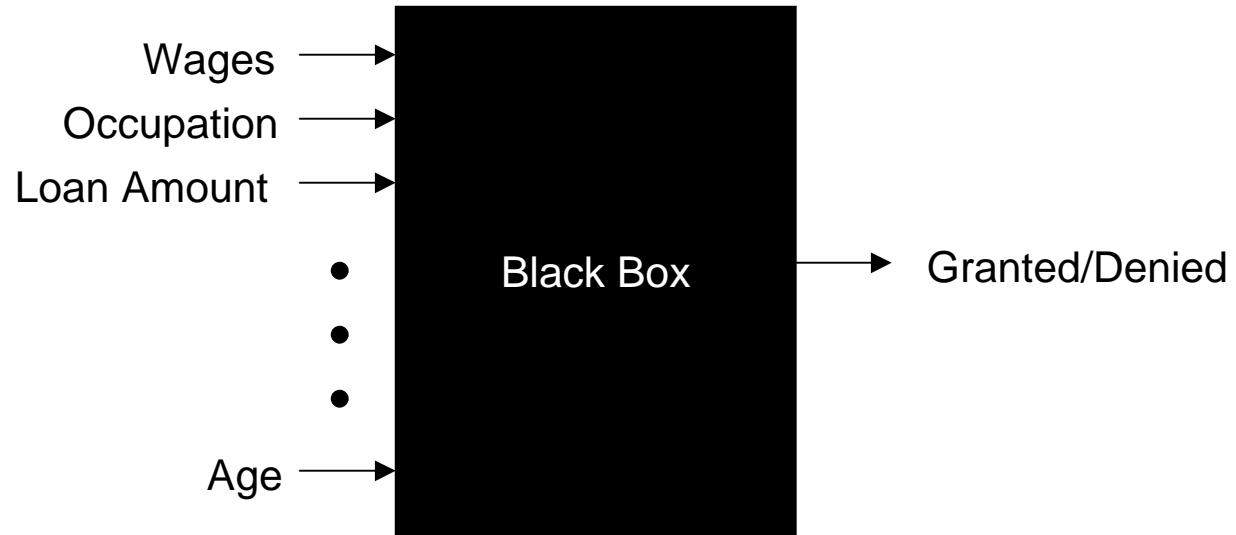
Credit - Approaches

- Human Judgement
- Neural Network
- Bayesian Network

Human Judgement

- Advantages
 - Personal Interaction
 - ‘Open’ for Special Cases
- Disadvantages
 - Complexity
 - Inconsistency
 - Inconvenience
 - Expensive

Neural Network



Neural Networks

- Advantages
 - Consistent
 - Easy to Learn
 - No Model/Expert Knowledge Needed
- Disadvantages
 - Only Testcases Where Credit was Granted
 - Black Box
 - Special Cases

Bayesian Network

- Advantages
 - Consistent
 - Insight in Decision Process
 - Not Dependent on Learning
 - DSL has Great Expertise
- Disadvantages
 - Number of Definition Values
 - Requires Model/Expert Knowledge

Credit - The Six C's

Defaulting

Credit History

Conditions

Character

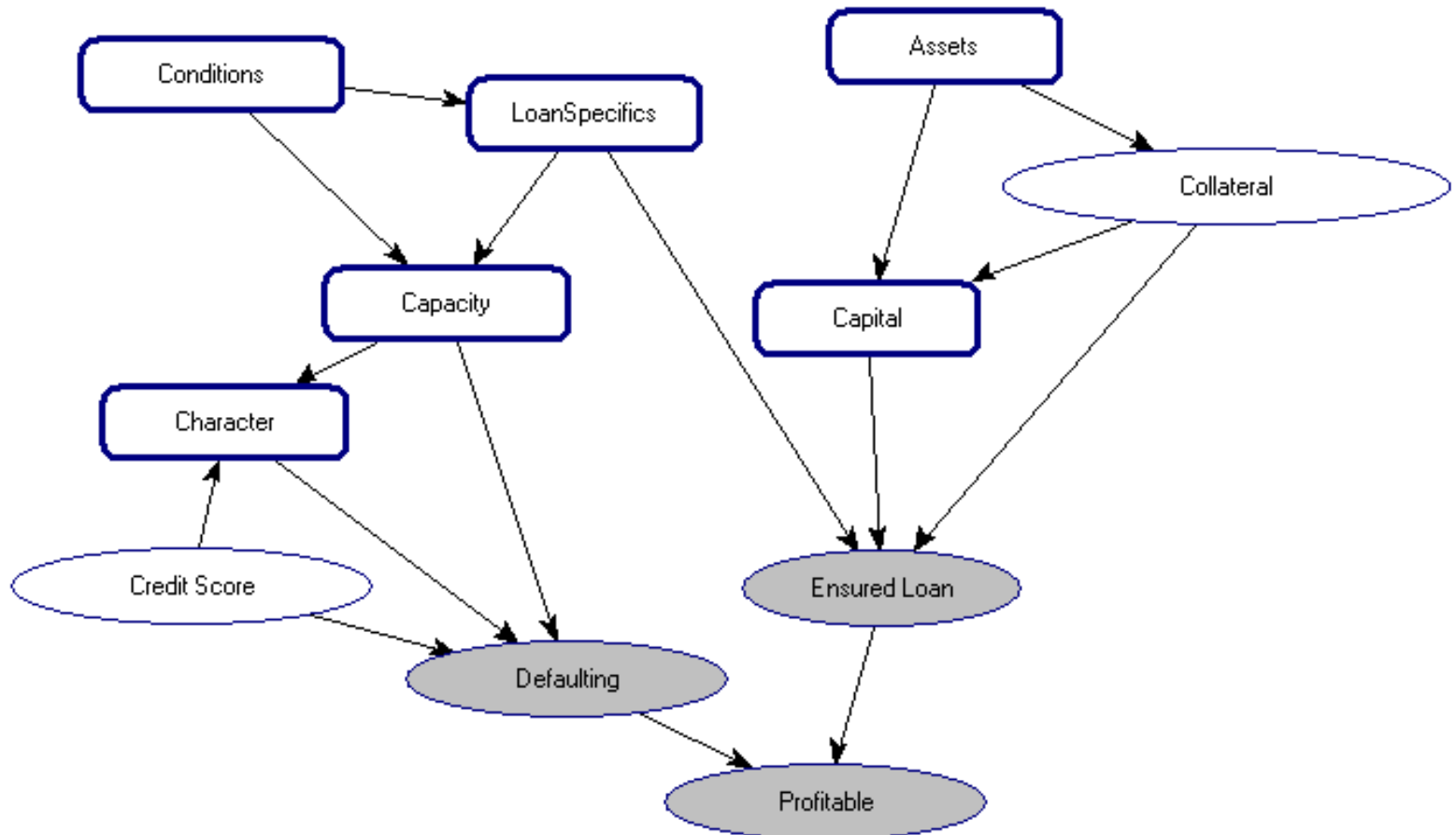
Capacity

Assets

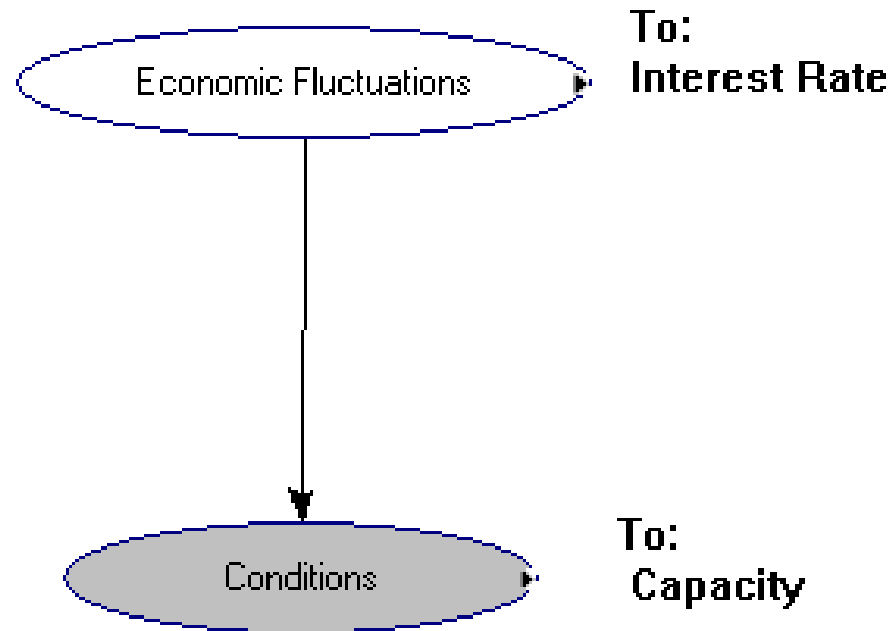
Capital

Collateral

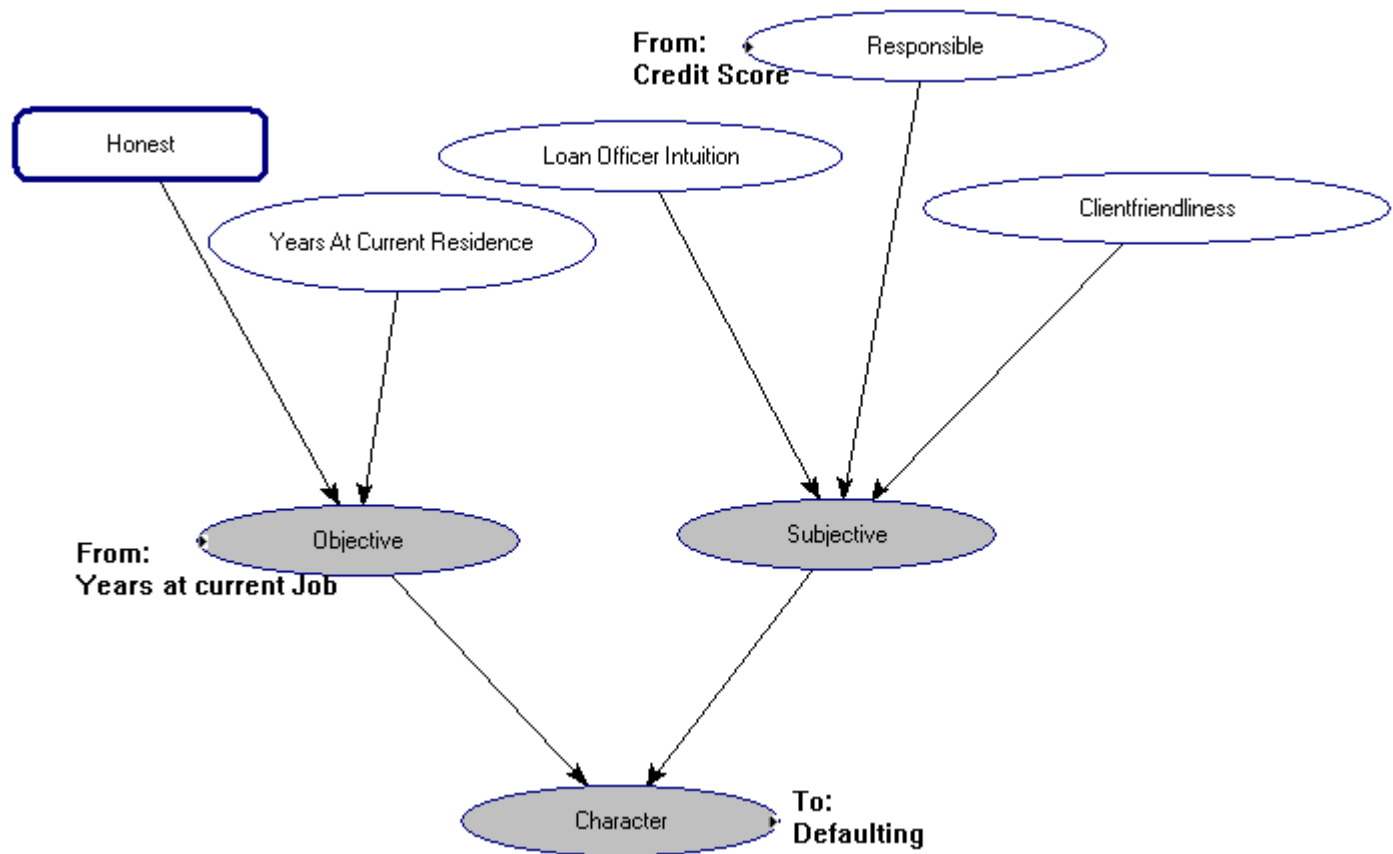
Credit - Bayesian Model



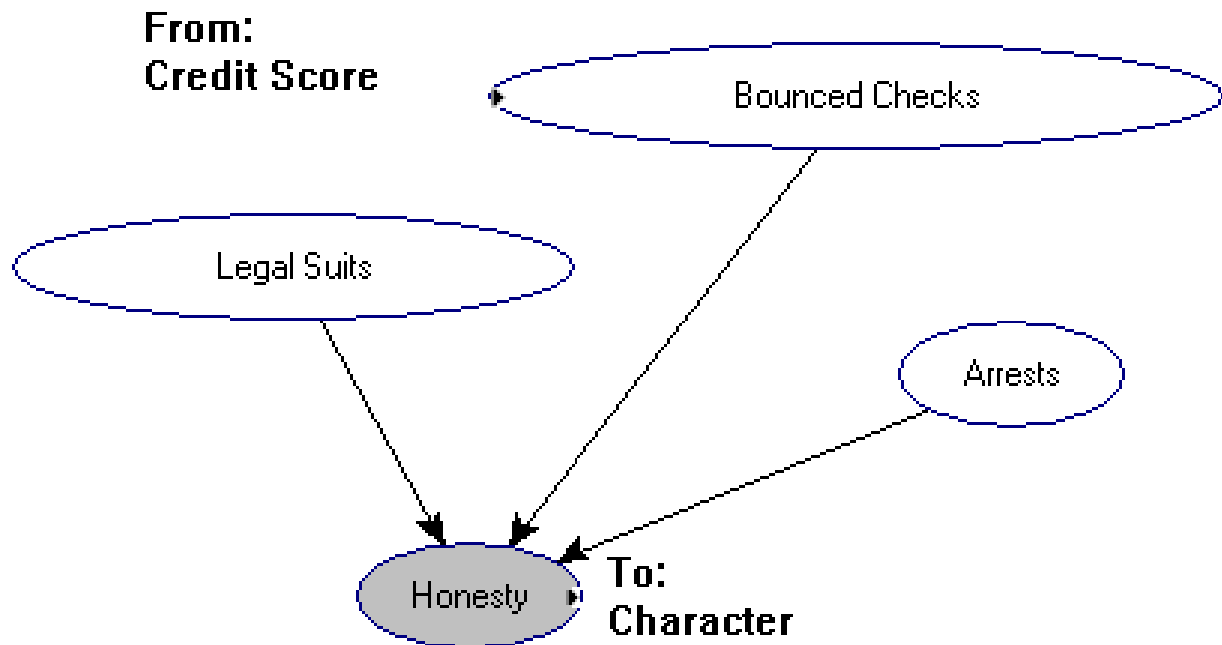
Submodel Conditions



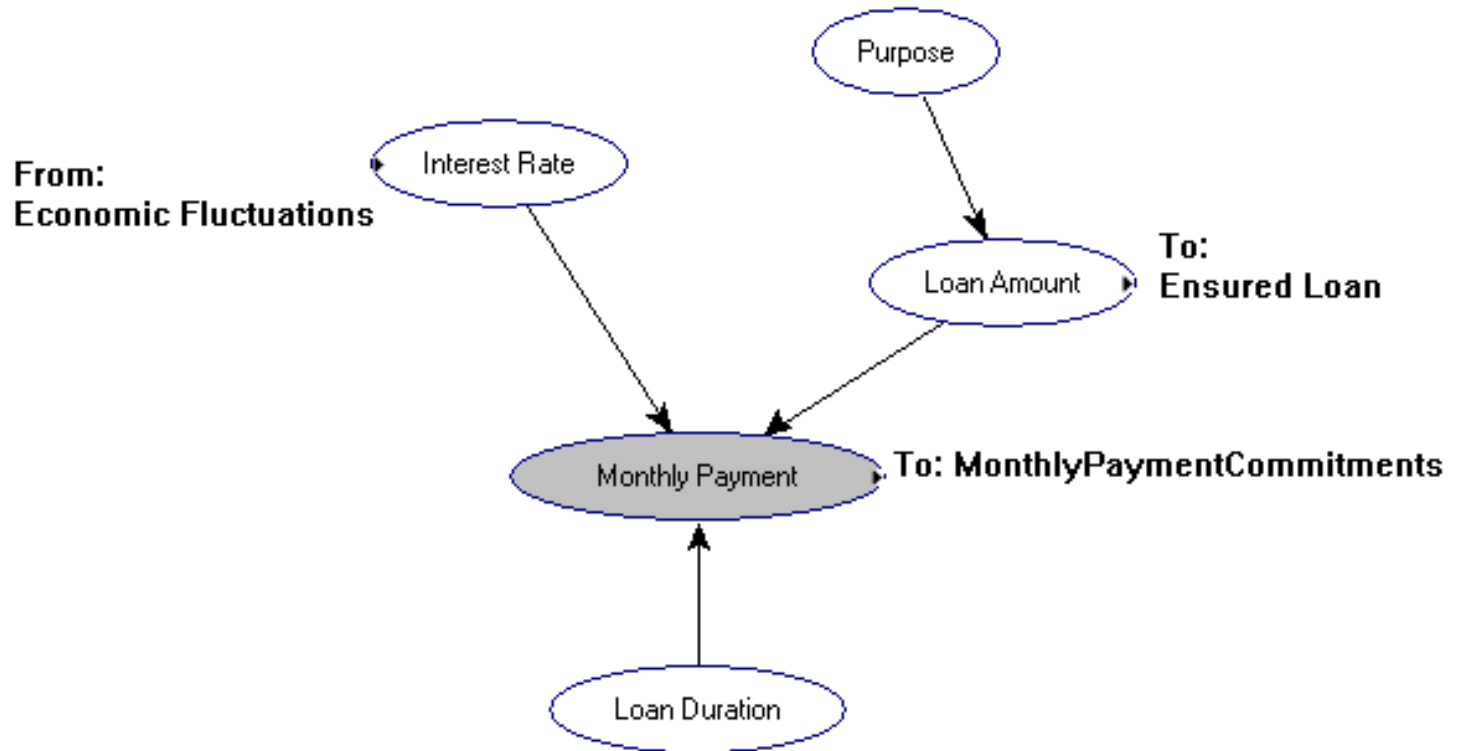
Submodel Character



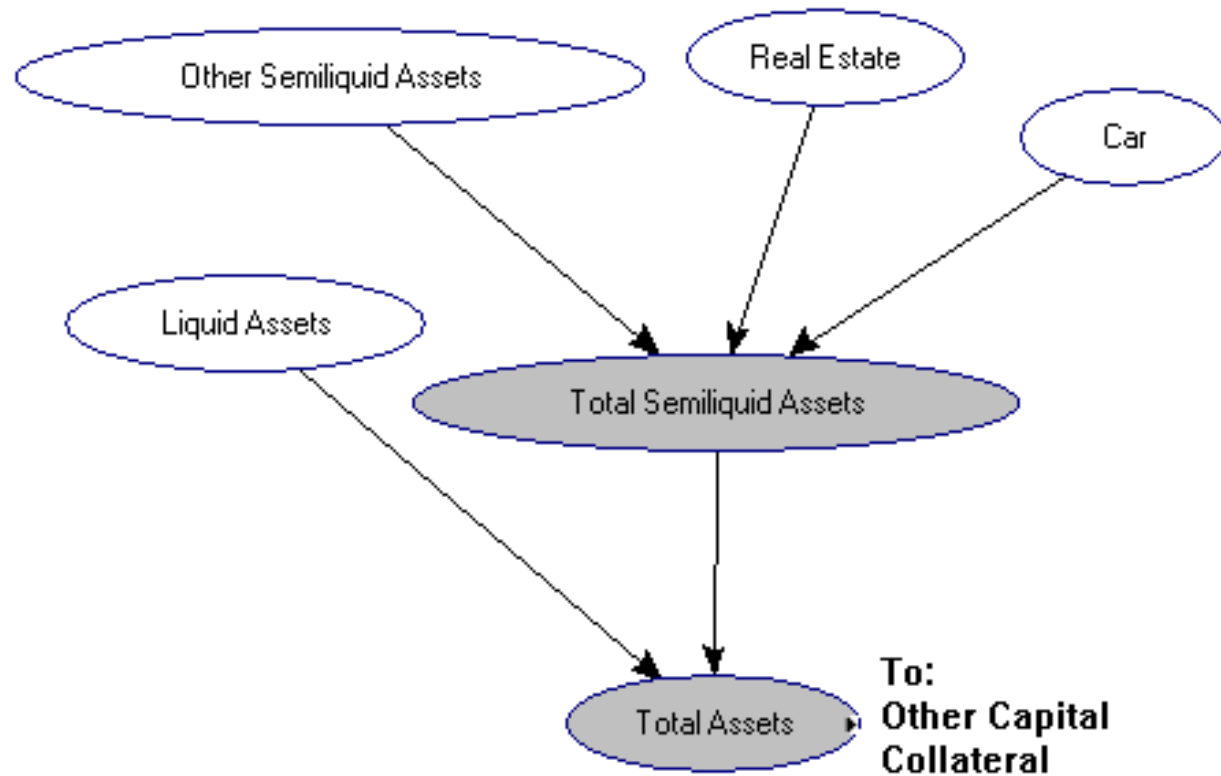
Submodel Honesty



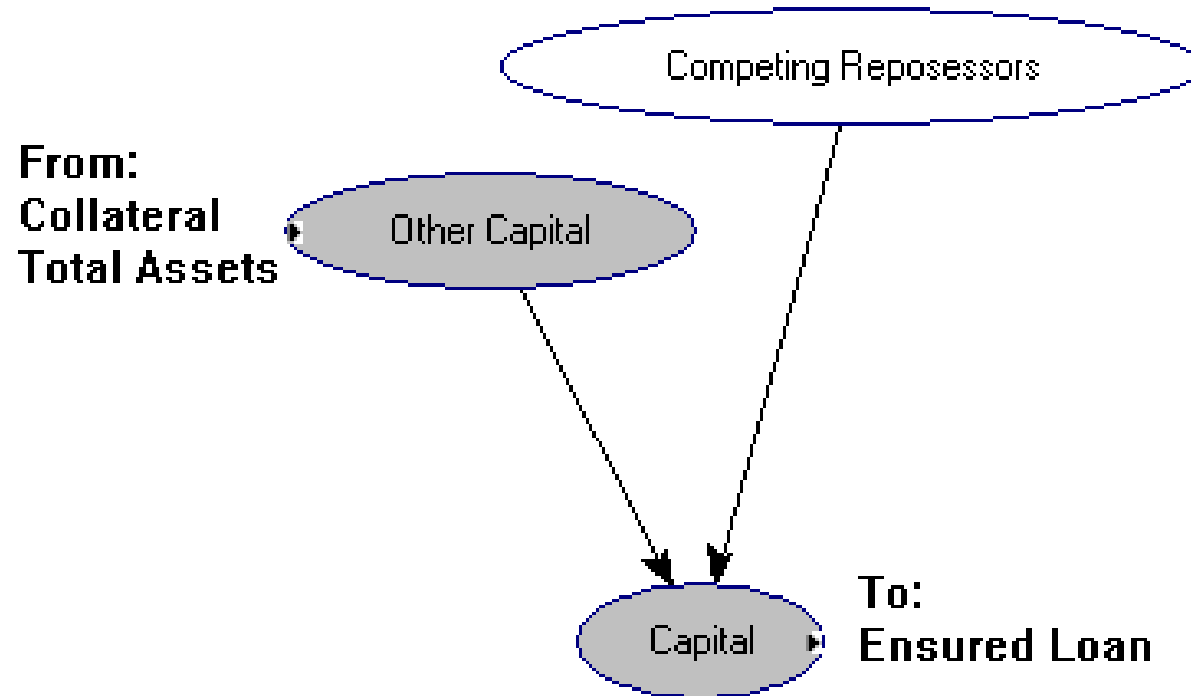
Submodel Loan Specifics



Submodel Assets



Submodel Capital



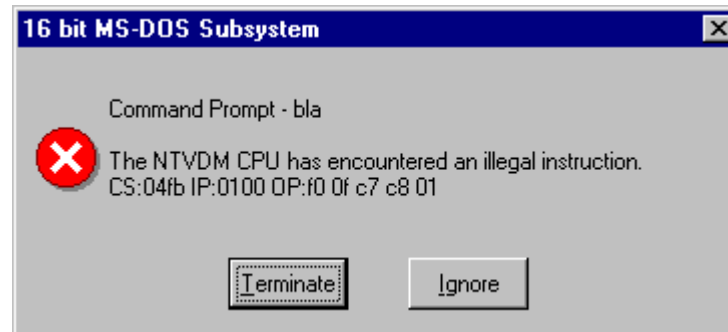
Credit - Acquiring the Numbers

- General Sources
 - Literature
 - WWW
- Expert Knowledge
 - Assessment of Uncertainties
- Prototype
 - Learned from Test Data

Credit - Applications

- WWW interface for Client
- Excel Interface for Bank

Demonstration



Control Panel

The screenshot shows a Microsoft Excel spreadsheet with a 'Control Panel' interface. The interface is organized into several sections, each with a title and a 'Run' or 'Calculate' button. The sections are:

- Control Panel**: A header section with a 'Clear' button.
- Network**: Contains input fields for 'File' (c:\credit\credit.dsl), 'Network ID' (Credit), and 'Network Name' (Evaluating credit risk in consumer credit). A 'Load' button is present.
- Test Cases**: Contains input fields for 'Total' (28), 'Unmatched' (5), and 'Percentage' (82%). A 'Run' button is present.
- Sensitivity Analysis**: Contains an input field for 'Testcase column' (AA). A 'Perform Analysis' button is present.
- Application Form**: Contains input fields for 'Monthly payment' (922 \$) and 'Result' (Granted). A 'Calculate' button is present.

The spreadsheet also shows a menu bar (File, Edit, View, Insert, Format, Tools, Data, Window, Help), a toolbar with various icons, and a status bar at the bottom indicating 'Ready'.

Overview

Microsoft Excel - credit

File Edit View Insert Format Tools Data Window Help

Arial 8 B I U \$ % , +.0 -.00

A1 = Submodel

	A	B	C	D	E	F	G	H
1	Submodel	Nodename	Nodeid	Measure	Origin	Low	Base	High
2	Main Model	Defaulting	defaulting	state	SmileX	Yes	Maybe	No
3		Ensured Loan	ensured	%	Calculated	0	85.3333333	100
4		Profitable	profitable	state	SmileX	No	Yes	Yes
5		Credit Score	creditscore	Points	TWR	300	680	800
6		Collateral	collateral	\$	Customer		5000	
7								
8	Loan Specific	Interest Rate	interest	%	Bank	6	8	12
9		Loan Amount	amount	\$	Customer	5000	15000	100000
10		Loan Duration	duration	#months	Customer	12	48	60
11		Monthly Payme	monthlypaymer	\$/month	Calculated		366.19	
12								
13	Capacity	Years at curre	yearsatjob	years	Customer	0-2	5	20
14		Occupation	occupation	state	Customer	Group1	Group3	Group5
15		Income Regular	incomeregularit	state	SmileX	VeryUnstable	Normal	VeryStable
16		Age	age	years	Customer	0-18	30-35	80>
17		Income Prospe	incomeprospec	state	SmileX	Low	Medium	High
18		Wages	wages	\$/month	Customer	700	4000	9000
19		Other Income	otherincome	\$/month	Customer	0	100	500
20		IncomeAmount	incomeamount	\$/month	Calculated		4100	
21		Dependents	dependents	\$/month	Customer	0	150	2000
22		Car Payments	carpayments	\$/month	Customer	0	300	1200

Control Panel Overview Testcases Sensitivity App

Ready

Testcases

Microsoft Excel - credit

File Edit View Insert Format Tools Data Window Help

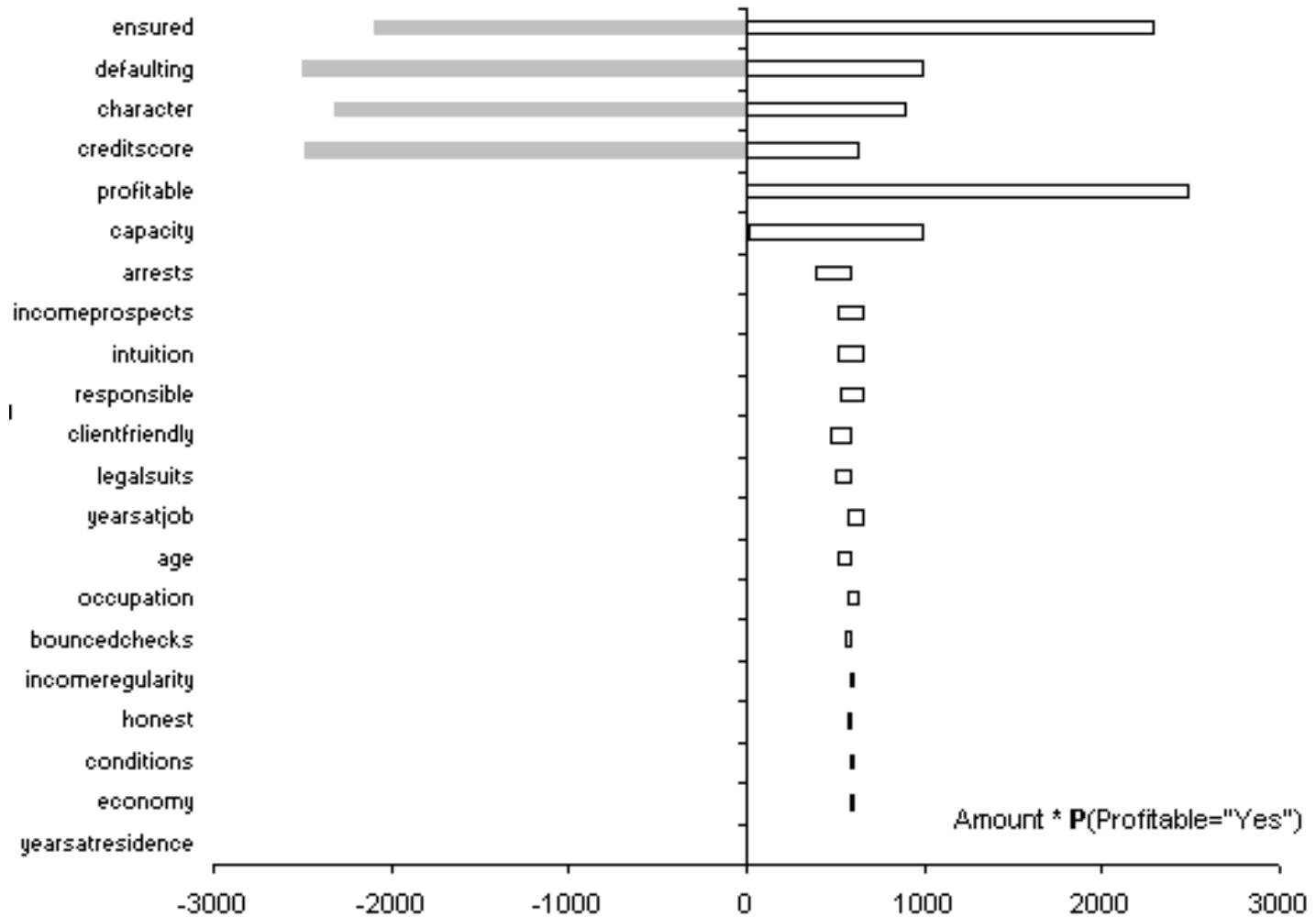
Arial 8 B I U

	A	B	C	D	E	F	G	H	I	J	K	L
1		Test1	Test2	Test3	Test4	Test5	Test6	Test7	Test8	Test9	Test10	Test11
2	SmileX Decision	Denied	Granted	Denied	Granted	Granted	Granted	Granted	Granted	Granted	Granted	Denied
3	Actual Decision	Denied	Granted	Denied	Granted	Denied	Granted	Granted	Granted	Granted	Granted	Granted
4	NodeID											
5	defaulting	No	No	No	No	No	No	No	No	No	No	No
6	ensured	24	100	17	77	92	100	78	100	100	62	46
7	profitable	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
8	creditscore	650	750	490	700	670	800	430	500	800	690	
9	collateral	2000	120000	1460	11900	5800	20100	11300	59250	916000	-62100	2900
10												
11	interest	8	10	7	8	8.2	6.7	9	8.5	9	7.1	
12	amount	10000	100000	12000	20000	15000	19000	17000	25000	50000	16000	
13	duration	48	60	36	36	24	24	48	36	36	24	
14	monthlypayment	244.13	346.00	370.53	626.73	679.78	848.10	423.05	789.19	1589.99	717.09	563.9
15												
16	yearsatjob	1	10	1.5	3	7	6	18	9	16	5	
17	occupation	Group1	Group5	Group1	Group3	Group2	Group4	Group3	Group2	Group5	Group3	Group1
18	incomeregularity	Unstable	Stable	Normal	Stable	Stable	Stable	Stable	Unstable	Stable	Stable	Normal
19	age	26	35	28	30	36	33	48	40	52	29	
20	incomeprospects	Low	High	Low	Medium	Medium	Medium	Medium	Medium	High	Medium	Low
21	wages	3500	8000	1900	2100	2000	4000	2200	1900	9000	1950	
22	otherincome	0	2000	0	100	0	0	0	200	250	0	
23	incomeamount	3500	10000	1900	2200	2000	4000	2200	2100	9250	1950	840

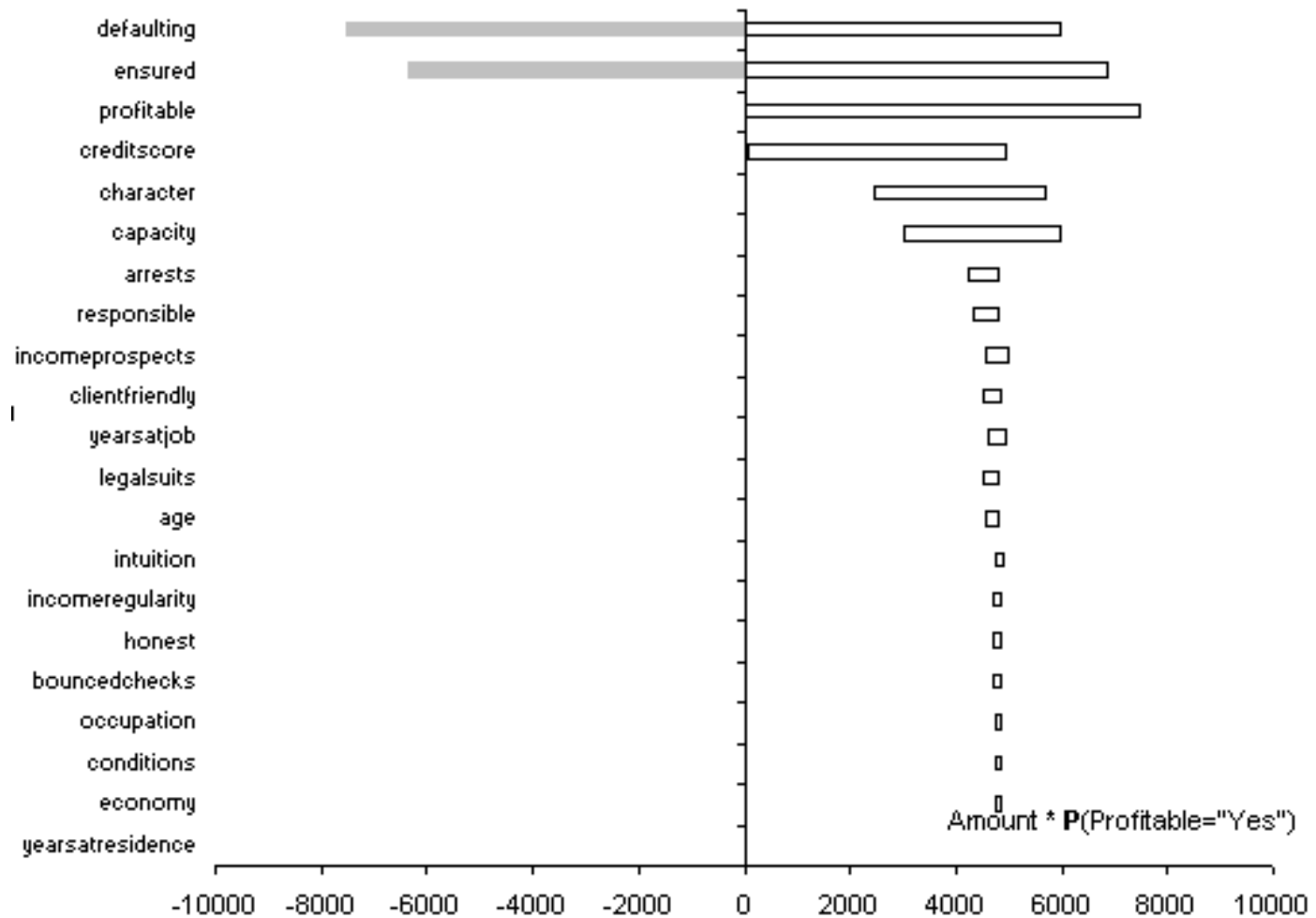
Control Panel Overview Testcases Sensitivity Application Form

Ready

Sensitivity - Creditscore



Sensitivity - Ensured



Excel - Application Form

Microsoft Excel - credit

File Edit View Insert Format Tools Data Window Help

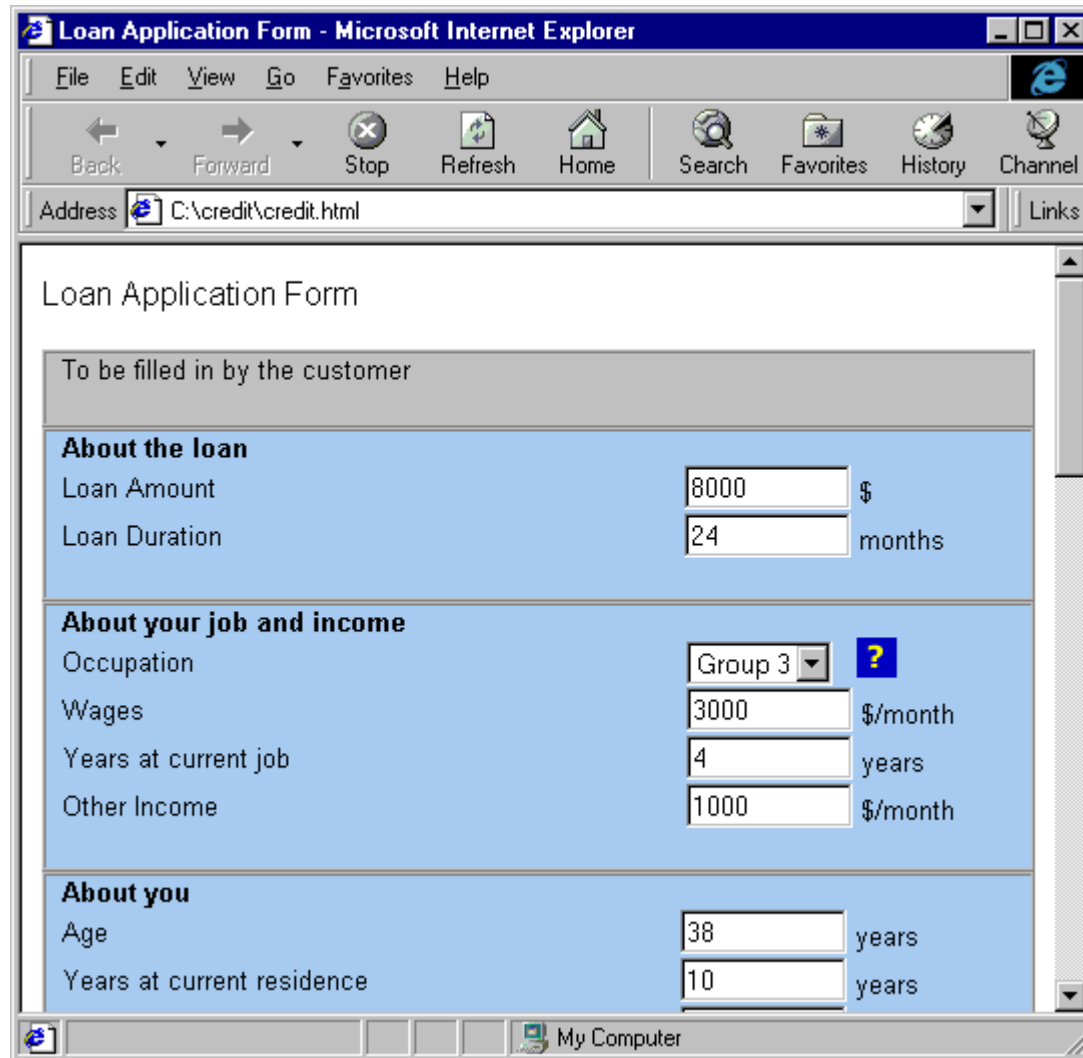
Arial 8 B I U

A1 =

	A	B	C	D	E	F	G	H	I
1									
2		Application for Credit							
3									
4		To be filled in by the customer				To be filled in by the bank			
5									
6									
7		About the loan				Annual percentage rate 8 %			
8		Loan amount		25000	\$	Credit Score 500 Points			
9		Loan duration		30	months	State of Economy Stable			
10						Clientfriendliness Normal			
11		About your job and income				Intuition Normal			
12		Occupation		Group3		Responsible Normal			
13		Wages		4900	\$/month				
14		Years at current job		2	years				
15		Other income		300	\$/month				
16									
17		About you							
18		Age		26	years				
19		Years at current residence		5	years				
20		Number of legal suits you fought		0	#				
21		Number of times you have been arrested		0	#				
22		How often do you write bounced checks?		Never					

Ready

WWW - Application Form



The screenshot shows a Microsoft Internet Explorer window titled "Loan Application Form - Microsoft Internet Explorer". The address bar displays "C:\credit\credit.html". The page content is as follows:

Loan Application Form

To be filled in by the customer

About the loan

Loan Amount	<input type="text" value="8000"/>	\$
Loan Duration	<input type="text" value="24"/>	months

About your job and income

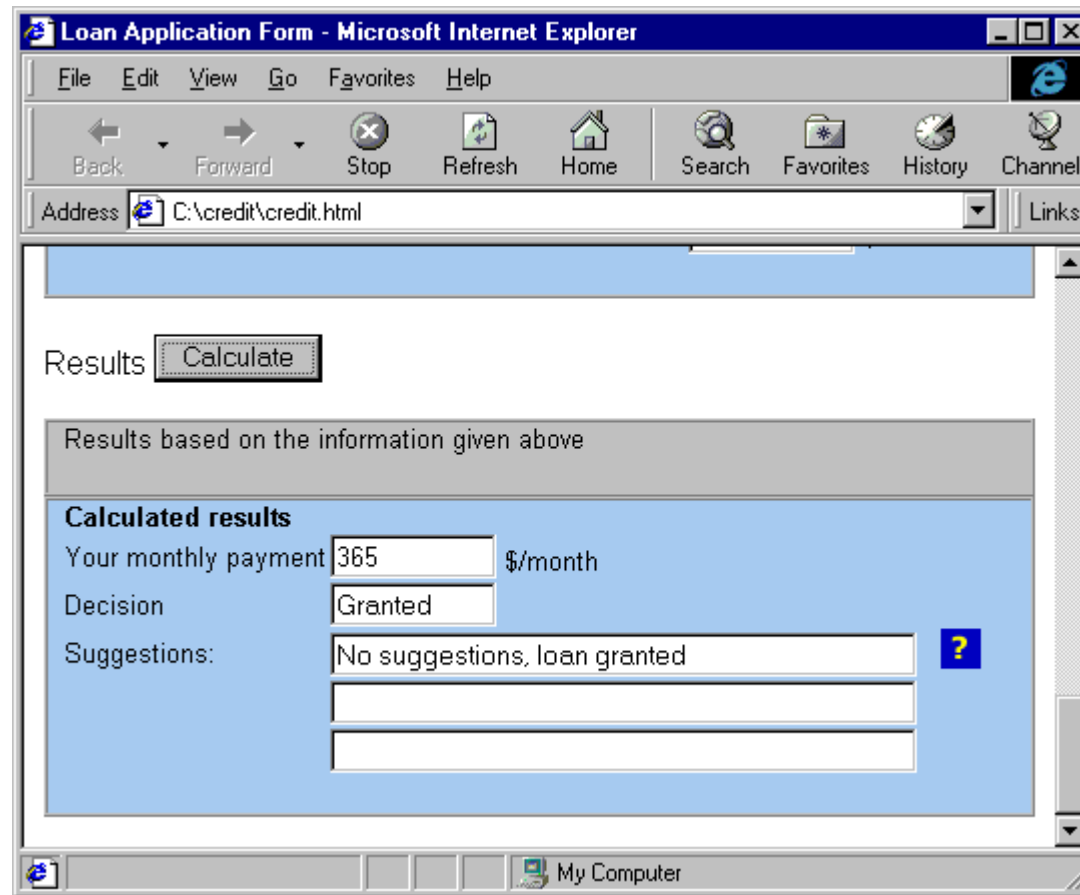
Occupation	<input type="text" value="Group 3"/>	<input type="button" value="?"/>
Wages	<input type="text" value="3000"/>	\$/month
Years at current job	<input type="text" value="4"/>	years
Other Income	<input type="text" value="1000"/>	\$/month

About you

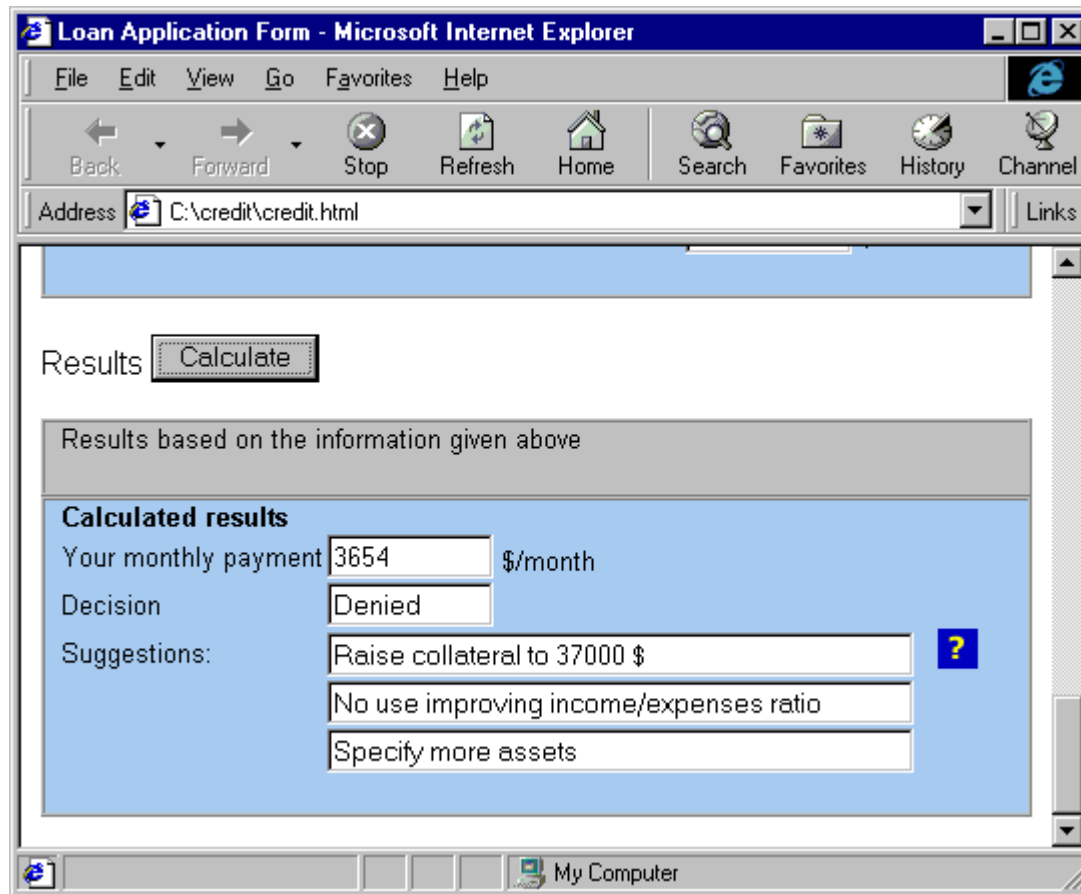
Age	<input type="text" value="38"/>	years
Years at current residence	<input type="text" value="10"/>	years

The browser's taskbar at the bottom shows "My Computer" as the active application.

WWW - Granted



WWW - Denied



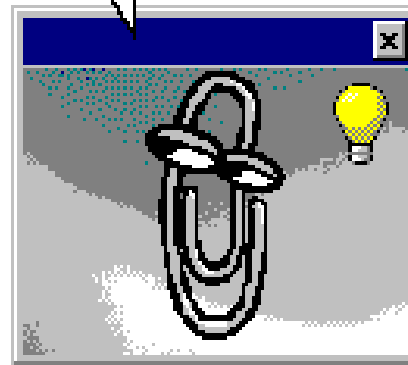
Conclusions

- SmileX
- Creditworthiness Model
- Future Plans
- Broad Perspective

Questions?

What would you like to do?

Type your question here, and then click Search.



...

Eerst even op het cijfer wachten

Dan gaan we daarna echt feesten!