



ARGOS



# Argos credit scoring module

## Introduction

The ARGOS system scores new and existing clients of financial institutions. The ARGOS Credit Scoring module uses the information and attributes acquired during a standardised credit origination process. Typically, this information is processed in client intake forms, evaluation forms, and financial overviews. The system is server based and can work via the Internet, Extranet or an internal network. On the user side the application presents itself through a regular browser. The ARGOS system is entirely based on open-source components and an open-source database.

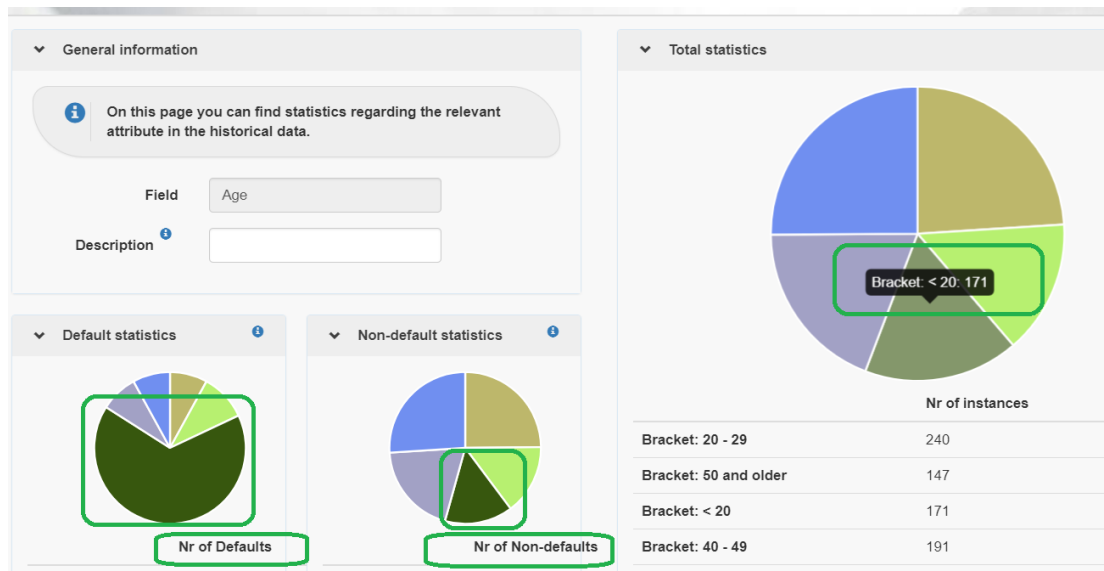
## Getting started

To kick-start the ARGOS Scoring system a set of historical loan portfolio is uploaded into the system. This can be done through a file such as Excel, CSV, XML or JSON, a web-service, or on a database level in an existing banking system.

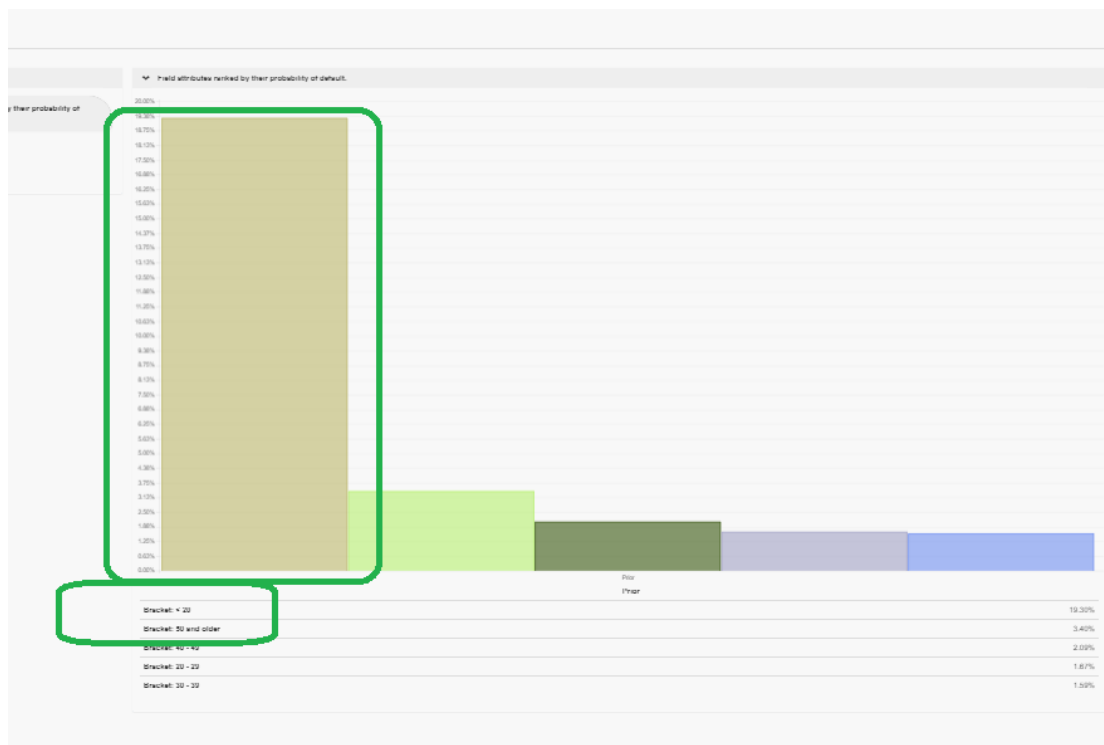
## Statistical overview

The ARGOS system produces and maintains a statistical breakdown of the historical lending portfolio and determines the differences in attributes between fully reimbursed loans and problem credits.

This statistical overview immediately provides insight into which attributes present increased default risk. In case an attribute does not have a link with the default behaviour, the financial institution might consider eliminating this question from the intake process thus simplifying the forms and paperwork.



**Figure 1** Breakdown by age: the age bracket under twenty has a strong presence in the dossiers in distress.



**Figure 2** Breakdown of the field attributes by contribution to default risk: the category under 20 jumps to the front.

## Intake interview forms

The Argos Scoring Module automatically generates an on-screen intake form itemising the questions that were previously included in the loan origination paperwork.

The screenshot shows the 'Data input' tab of the Argos Scoring Module. At the top, there are four tabs: 'Data input' (selected), 'Bayesian scoring', 'Expert scoring', and 'Workflow'. Below the tabs is an information bar that says: 'Please fill out the values for each of the categories below. Once you are done, you can continue to the Bayesian Scoring tab or any other tab.' Below this is an 'Input list' section with a dropdown arrow. The list contains four entries, each with a radio button, a 'Field' label, and an 'Input' dropdown menu. The entries are: Gender, Age, Activity, and Married. The 'Input' dropdown for 'Industry' is open, showing a list of options: Industry, Cattle farm, Commerce, Agriculture, and Service. The 'Showing 1 to 4 of 4 entries' text is visible at the bottom left of the input list.

**Figure 3** The Argos system generates automatically an input form with all the possible options listed in the pull-down menu.

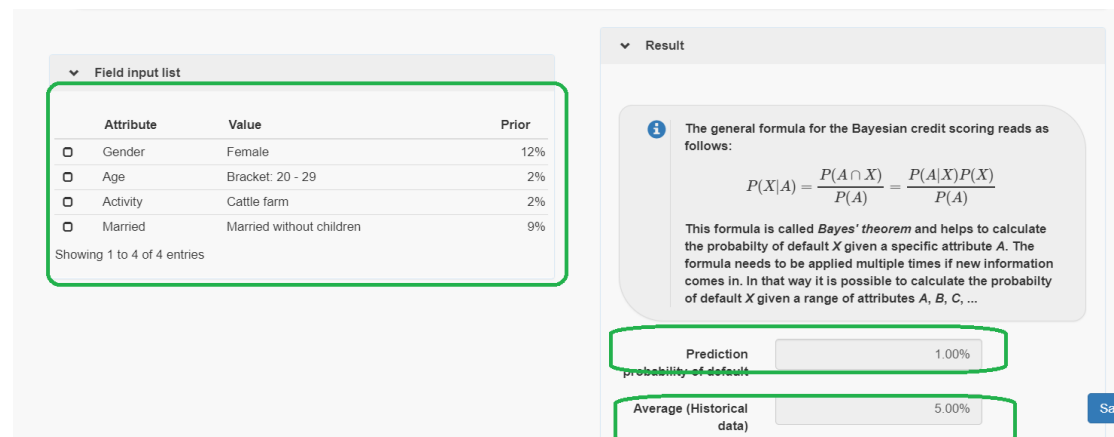
For each of the question a pull-down menu is generated listing the various answer options. This helps financial institutions to move to a paperless environment. Furthermore, all the data is stored and kept in a database and available for statistical analysis. Moreover, the Argos system keeps track in its audit log who filled out what information when. This is an important for future audits.

## Multiple credit scoring approaches

The Argos Scoring Module offers multiple scoring models that can be applied in parallel:

1. The Bayesian method based on historical data;
2. The logistic regression method based on historical data;
3. The expert method based on the credit managers' expertise, and
4. Scientific models based on financial and economic theory, for which we present the Altman Z-score as an example.

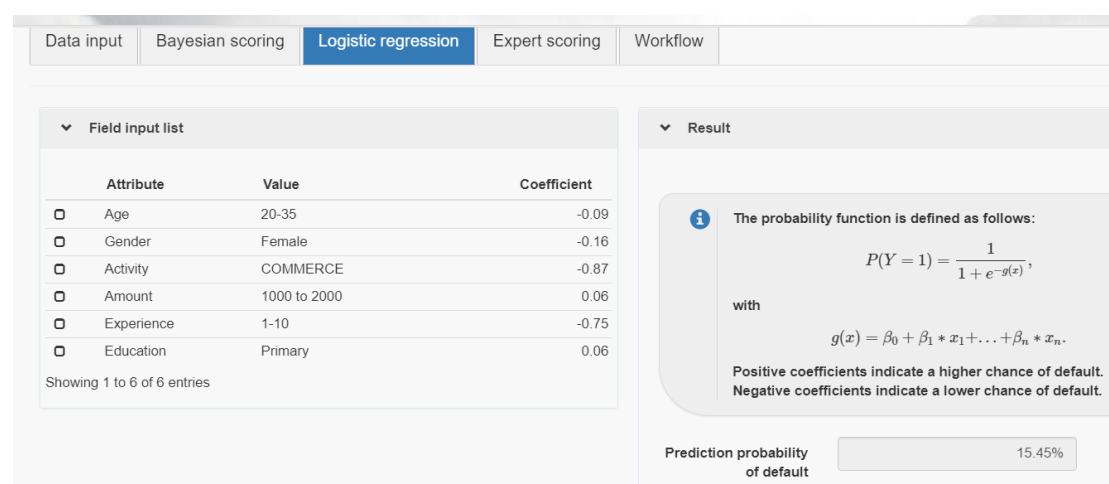
## Bayesian approach



**Figure 4** Bayesian scoring: the prior expected PD is 5%, however, given that the client is female, aged 24, is married and runs a cattle farm, the expected PD is just 1%. We see the impact of the various attributes on the PD to the left.

## Logistic regression approach

The logistic regression approach builds on the well-known linear regression method but allows for non-continuous variables. The outcome of a logistic regression analysis is called the odds on a 0-100% scale. These odds can be interpreted as a PD value.



**Figure 5** Logistic regression scoring: the PD is calculated on the right bottom side. The Argos system also provides the coefficients necessary to produce the logistic regression function.

## Expert approach

Often financial institutions make use of a home-made expert scoring system that weighs the answer provided by the client. The Argos Scoring Module provides a convenient configuration screen to capture this expert scoring, the configuration asks for weighing each of the questions, with the sum of all weights equalling 100%, as well as weighing each of the possible answers. Probably, a team of seasoned credit risk staff is best suited to perform this task.

The screenshot displays the 'Expert model input' configuration interface. It consists of two main sections, each for a different attribute. The first section is for 'Gender' and the second is for 'Activity'. Each section has a 'Weight' field and a table of 'Option' and 'Score'.

Attribute	Weight	Option	Score
Gender	1	Female	1
Gender	1	Male	3
Activity	2	Agriculture	3
Activity	2	Cattle farm	3

**Figure 6** Configuring the expert scoring module by assigning weights to the various intake questions and the answer options. High grades indicate a lower default probability.

The Argos system will calculate a weighted and unweighted score for each loan request.

Data input
Bayesian scoring
**Expert scoring**
Workflow

*This page shows the results of the Expert credit scoring. Please fill out the values for each of the categories below. Once you are done, you can continue to click on **Calculate scores** in order to calculate the final score for the given input.*

For the Expert Scoring, the following rule applies: *The higher the scores, the better the expected performance of the case.*

Field input list

Attribute	Input	Weight	Score	Average score	Max. score
<input type="checkbox"/> Gender	Female	1	1	3.12	4
<input type="checkbox"/> Age	Bracket: 20 - 29	1	4	3.63	5
<input type="checkbox"/> Activity	Cattle farm	2	5	2.87	5
<input type="checkbox"/> Married without					

Result

Expert scoring
78.95%

Expert scoring (weighted)
83.33%

**Figure 7** Results of the expert scoring are shown to the right: in this example a high score indicates a low default probability. To the left a break-down of the various scoring attributes.

Many financial institutions will opt for using the expert scoring, logistic and Bayesian scoring in parallel. It is possible to use a combined score for which the two scores are weighted by the management.

## Scoring based on financial statement

It is important to notice that the Altman Z-score is just an example for a class of credit scoring models. Other models could be used if the underlying logic is known, and the input parameters will be available. The Altman Z-score is entirely based on data available in the applicant's income statement and balance sheet.

Component	Weight	Definition
X1	1.200	Working Capital / Total Assets
X2	1.400	Retained Earnings / Total Assets
X3	3.300	Earnings Before Interest and Taxes / Total Assets
X4	0.600	Market Value of Equity / Total Liabilities
X5	0.999	Sales / Total Assets

**Figure 8** The Altman Z-score uses intermediate ratios based on financial report data. The ratios are weighted.

Using an intermediate step, the Altman Z-score is calculated and scaled to a three-step outcome: 1) Safe, 2) Grey, and 3) Distress. This scoring approach does not re-

quire uploading historical data and is geared toward the scoring of larger companies.

Figure 9 Configuring the weights in the Altman Z-score and determining the cut-off values for the scoring results.

Figure 10 Entering the financial data and the calculation of the Altman Z intermediate ratios to the right.

Figure 11 Altman Z score with interpretation.

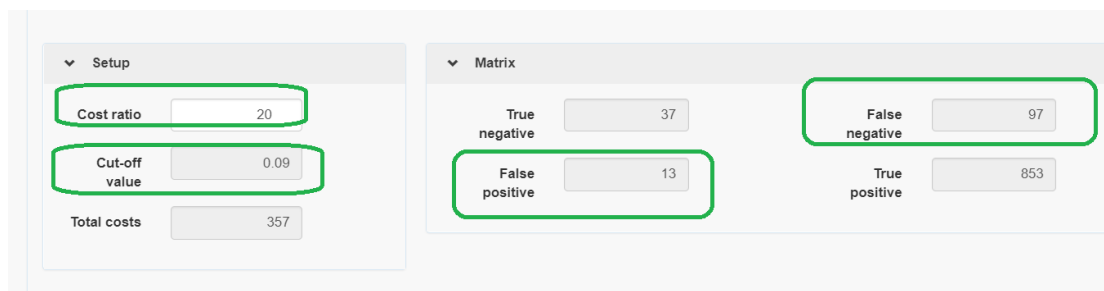
It is important to repeat that the Altman-Z score is just one example of possible scoring approaches using financial report inputs.



## Performance tracking

The performance of the score system is continuously monitored against historical loan data. Well-known methods such as the confusions matrix, the Receiver Operating Characteristics (ROC) an Area Under Curve (AUC) are used.

A confusion matrix shows the performance in the numbers of false positives and false negatives. In other words, how many clients would the model have accepted that should not be accepted, and, how many clients would the model reject that should not have been rejected? Ideally, both numbers are zero. There is a trade-off between false positives and false negatives: the stricter the bank's credit demand evaluation policy, the lower the number of false positives. However, the collateral damage will be a larger number of false negatives. Conversely, the more relax the bank's policy, the higher the number of false positives. It is important to underline that for most financial institutions these two events do not have an equal impact. Accepting a client that one should not have accepted will result in a much bigger loss than forgoing the margin on a client that was sent away unjustly. If the bank makes a gross margin of 5% on a loan, it would take twenty good loans to compensate for one complete write-off. This is would result in a 1 : 20 ratio.



**Figure 12** Confusion matrix showing the model's performance in terms of false positives and false negatives. The cost ratio is in this example set at 1 : 20.

The system also optimises the cut-off value to make the optimal decision between accepting or rejecting a credit demand, taking into consideration the cost value defined earlier. This cut-off value could be used to channel credit request via various approval processes within the bank.

## Audit log

All actions of users are tracked via an audit log to meet accounting requirements.

Audit log

Export

Search:

Actor

Contains

Go

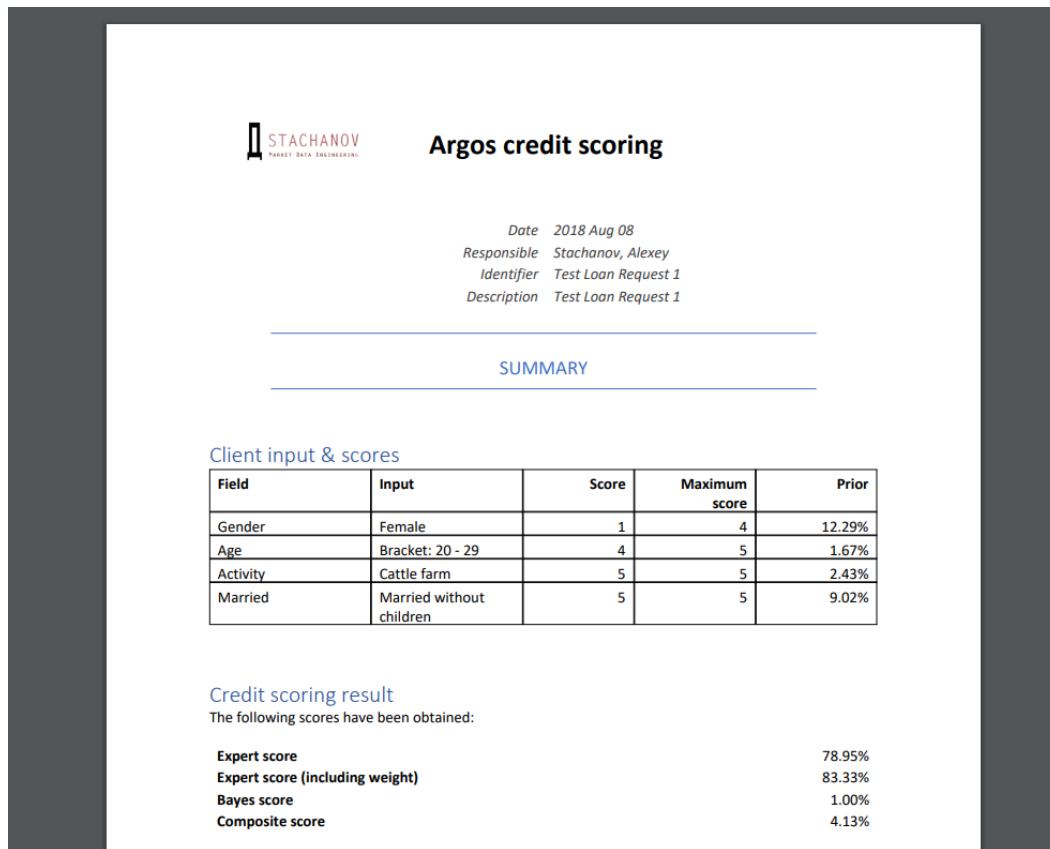
Actor	Database object	ID	Property name	Event name	Old value	Current value	Date created	Last updated	URI
<input type="checkbox"/> super	SecUser	1	userLanguage	UPDATE	com.stachanov.internal.i18n.Language : 1	com.stachanov.internal.i18n.Language : 3	2017-12-10 14:05	2017-12-10 14:05	
<input type="checkbox"/> super	TranslationFile	7		INSERT			2017-12-10 14:08	2017-12-10 14:08	
<input type="checkbox"/> super	TranslationFile	7	dateProcessed	UPDATE		Sun Dec 10 14:08:25 CET 2017	2017-12-10 14:08	2017-12-10 14:08	
<input type="checkbox"/> super	TranslationFile	7	dateUploaded	UPDATE		Sun Dec 10 14:08:22 CET 2017	2017-12-10 14:08	2017-12-10 14:08	
<input type="checkbox"/> super	TranslationFile	8		INSERT			2017-12-11 16:00	2017-12-11 16:00	
<input type="checkbox"/> super	TranslationFile	8	dateProcessed	UPDATE		Mon Dec 11 16:00:40 CET 2017	2017-12-11 16:00	2017-12-11 16:00	

**Figure 13** The audit log tracks all changes in the system: who has done what, when?

The Argos Credit Scoring Module generates automatically a PDF with all the scoring information that can be downloaded or printed. This document could be presented to the bank's credit committee or management.

## Printable reports

It is possible to create Word, Excel and PDF reports based on a template and data in the system. This way a credit proposal or even a loan contract can be generated.



**Figure 14** Example of PDF generated by the Argos Scoring Module.

## Connectivity

Financial institutions can use the Argos Credit Scoring Module on a stand-alone basis or choose to embed the scoring module in a complete Argos Workflow System. All the Argos platform components are based on open-source technology which has obvious benefits in terms of support and license fees. The Argos platform can interface with existing core banking systems through web services or based on file uploads in standardised formats such as CSV, XLXS, JSON, and XML.

## Conclusion

The Argos Credit Scoring module is a comprehensive and transparent scoring solution that can easily be implemented in existing and new loan origination processes.

## About us

ARGOS is a product developed by our specialists who are always prepared to answer your enquiries. If you are interested in the Argos credit scoring system, and would like to know more about it, our partners are pleased to give you a presentation and a product demonstration to show all its features. by STACHANOV, a company located in Amsterdam, the Netherlands. The company is a renowned niche-specialist in the design, construction and implementation of financial models and IT-applications for the financial industry. At STACHANOV, we distinguish ourselves through vigour, a lust for work and dedication. We have been delivering solutions to clients, at home and overseas, for over fifteen years. Relations appreciate our serious, no-nonsense attitude, and our ISO-certifications regarding 9001, 14001 and 27001 support our professional approach and execution.

## Company information



### **STACHANOV**

Lamonggracht 7  
Java Island  
1019 RD Amsterdam  
The Netherlands  
Tel : +31 20 509 10 10  
Fax : +31 20 509 10 19  
E-mail : [info@stachanov.com](mailto:info@stachanov.com)



Chamber of Commerce: 34247181 0000  
General Terms of Business deposited: July 5, 2010  
VAT number: NL-815655320 B 01  
D-U-N-S number: 386311708  
Bank account: RABO 148968694  
BIC / Swiftcode: RABONL2U  
IBAN: NL53RABO0148968694

## Contact us

In case you have any questions about Argos or our company, feel free to contact us or check out our website ([www.argos.com](http://www.argos.com)). Our specialists are always prepared to answer your enquiries. If you are interested in the Editua system, and would like to know more about it, our partners are pleased to give you a presentation and a product demonstration to show all of its features.

**André Koch**

Partner

T +31 (0)20 509 1010

M +31 (0)6 511 85 564

E [andre@stachanov.com](mailto:andre@stachanov.com)