New applications for actuarial techniques;

The Claims Management Filter (CMF)

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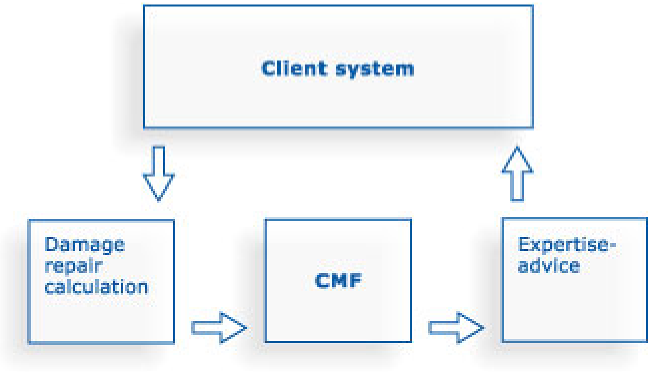
Combining techniques in different areas often leads to surprising results. An example of this is our Claims Management Filter for car damage repairs that filters inconsistencies and price deviations from repair quotations and that provides repair shops with a qualitative rating. The statistics that are used for this belongs to the standard set of the actuary: The general linear model (GLM) methods for risk analysis used for rating and determining the convex set of events with a probability of occurrence smaller than a fixed percentage. The above combined with a web service that performs tests on demand leads to the Claims Management Filter, an application that provides substantial savings for claims handling at motor insurance companies.

The last few years the process progress related to car repairs has stepped up considerably. Previously, weeks went by between the moment the collision occurred and the day on which the vehicle was again made available in a roadworthy condition. Currently, this is a question of days because the waiting time is a fraction of what it was previously due to new communication technologies.

The process phases are the following for the insurance company: Receipt of the damage report, verification of the insurance policy, assessment of the damage, assessment of the damage repair quotation and whether expertise is required or not: deploying or not deploying experts or teleworking, and approval of the calculation. For the repair shop: transportation of the damaged vehicle, calculation of the repairs, quotation and repair.

Posthuma Partners has contributed significantly to this time reduction by developing the Claims Management Filter (CMF). CMF ensures you can efficiently check the repair process without this being linked to losing control relative to the amount of the costs. Optimal control with cost and time savings without quality being negatively affected; CMF speeds up this process and provides efficient and effective claims handling.



The technical part of CMF

The technical side consists of a collection of qualifications and technical data such as the properties of the vehicle, the components to be replaced, the qualifications of the repair shop and the costs related to labor, spraying and sheet-metalwork.

This data is available in a standardized and computerized manner. The logical relationship of all this information is verified with CMF. CMF contains a large number of standard rules but, in addition, hundreds of rules can be programmed by the user by means of a rule generator. Some metallic paint types are only used for specific types of vehicles. Often, these special paints are extremely expensive. A verification rule can check whether the claim of such a paint type is allowed logically.

The statistical part of CMF

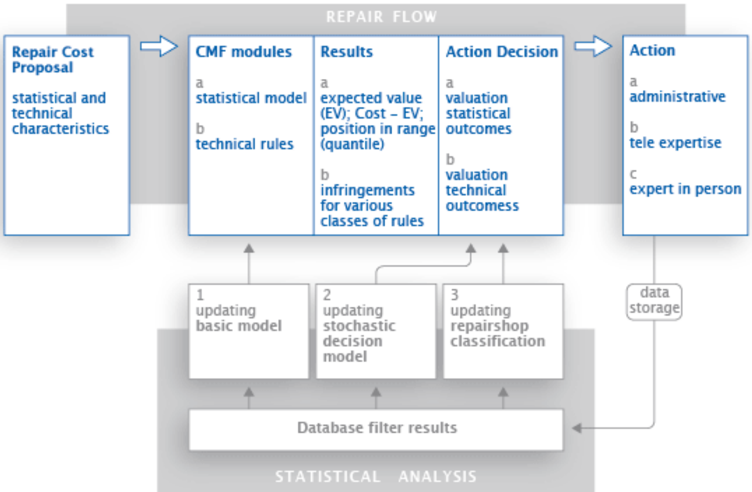
The costs related to repairs are modelled through GLM analyses in the statistical part. Explanatory variables include the nature and seriousness of the collision: cause and reference point, brand, type and construction year of the vehicle, region, road number, etc.

Every new claim quotation is offered through the Internet in a standardized form to the CMF web solver. It is compared with the theoretical cost result as determined with the GLM based on the above characteristics.

Identified issues from the technical part and the statistical comparison between theory (GLM) and practice (the quotation to be assessed) must at once lead to the decision whether the loss can be approved administratively, additional information must be requested or an expert must assess the quotation on site. This decision may be taken by a claims handler based on the CMF results but the decision process can also take place fully automatically.

CMF summarised schematically

Every new quotation is assessed in CMF; this means that a priority is allocated to the claim depending on the characteristics of that claim. This takes place through a percentile allocation with regard to the different cost components (relative to the vehicle body: labor, spraying and component costs) and the identified technical inconsistencies.



GLM analyses form the basic model

The basic model consists of a number of GLM analyses with which the systematic factors have been determined. These GLM analyses can be compared in their entirety with those that are normally performed for determining premium structures. The system determines to which percentile the result belongs for every new claim calculation depending on its characteristics and the assumed exponential probability function for deviations. This percentile will, therefore, specify to which percent of the cases the present proposal could have been cheaper (and, of course, the complement 100 – x%, that is, by how many percentage points this repair could have been more expensive).
If the quotation should have an expected amount of the claim of € 1,250 in accordance with the related loss characteristics and the actual amount of the claim amounts to € 3,000 and the deviation is modelled using a gamma function (with $\alpha = 2$ and $\beta = 900$), then the percentile for this claim is 85. This loss should, therefore, cost less than the offered amount of € 3,000 in 85% of cases.

Decision model and selection technique

A cost/benefit analysis has been made during an initial analysis to determine for which (groups of) quotations it would be worthwhile to incur additional expenses for a further assessment by expertise (either by sending an expert on site or by requesting further information in writing).

Technical and statistical scores have been correlated; CMF eliminates this correlation without examining any causation. This takes place through the clustering of percentile results. The information below should explain matters.

Assume results of the 1-dimensional variable ξ (e.g. the costs of replacement components). A result of a random claim has been provided with a probable (projected) percentile through the GLM model at a basic level with which the characteristics (and the assumed error probability function) have also been taken into account. You could say that the replacement costs of new components based on the brand of the vehicle – Mercedes versus Volkswagen – has been corrected by the GLM structure.

The percentile results are random variables with an average μ_1 and a standard deviation σ_1.

The average could be slightly larger than 50 (due to the projection error) with a standard deviation of approximately

$$50 \times \frac{\sqrt{3}}{3}$$

(the standard deviation of a uniform distribution) on the lowest level (the claim).

Add here a second similar variable η with an average μ_2 and a standard deviation σ_2. The geometric representation of this 2-dimensional distribution in the 2-dimensional Cartesian plane can be through an ellipse by using the non-negative quadratic form around the centre (μ_1 , μ_2)

By: $c^2 = \sigma_1^2 \xi^2 + 2\rho\sigma_1\sigma_2 + \sigma_2^2\eta^2$, where ρ is the correlation coefficient between ξ and η.

This ellipse specifies the limit of the probability with which combinations of results of ξ and η fall inside or outside this ellipse.[1]

We, subsequently, verify for which limits of c^2 - and other conditions such as, for example, the condition that a minimum repair amount must be involved - it is worthwhile to incur expenses relative to additional (expertise) actions in the cost-benefit analysis.

Should we assume more than 2-dimensional probability variables (of cost components and technical scores), then we must consult the quadratic forms from linear algebra with regard to these cluster techniques.

Assume that we have *m* observations (claims or an average thereof) for *n* variables and that we wish to separate the “good” claims from the “bad” ones based on objective criteria.[2]

The standardized matrix *Y* consists of *n* columns for the *n* variables and *m* row for the *m* observations. Every row (observation set) consists of standardized results (for the average and the standard deviation of every variable).

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[1] H. Cramér, Mathematical Methods of Statistics, MIT 9th edition (1961)

[2] G. Strang, Lineair Algebra and its Applications, MIT 3rd edition (1988)

Based on the correlation matrix of Y :

$$corr = Y' \bullet Y$$; a (n,n) matrix

the (n,n) E matrix of eigenvectors and λ as its typical eigenvector (vector column) can be determined.

Y can, subsequently, be transformed as follows:

$$Y^* = Y \bullet E \bullet \lambda^{-\frac{1}{2}}$$

This produces new variables that are uncorrelated from a column perspective and for which it applies that the sum of the quadratic results can be used as a limit value for selection processes that can be compared with c^2 .

It has emerged that this technique is very effective for the basic selection of new quotations and the average selection to be repeated periodically (repair shop rating).

CMF is currently being used with regard to standardized car repair damages but it can also be made suitable for other standardized claim processes.