g-COM Medical

g a l o r – Cluster Optimization Model Medical: The solution for medical study analysis and personalized medication

Challenge

The response to the same or a similar medication typically varies by patient, depending on the patient's individual characteristics. The goal is to provide an accurate quantification and medically sound reasoning for these differences in response on the individual basis to gain a detailed understanding of the efficacy of the drug.

Benefits

The main benefit is improved prognosis and less side effects for patients due to more accurate medication of patients.

The quality and accuracy of the analysis allow pharmaceutical companies for broader market penetration and better negotiating position with health insurance companies.

Data mining and analytics techniques have become main stream not only in the analysis of drug studies. The predominant task in the analysis of massive data is the identification of (statistically) relevant structures and a subsequent valid prediction of future developments.

Extracting knowledge from medical studies

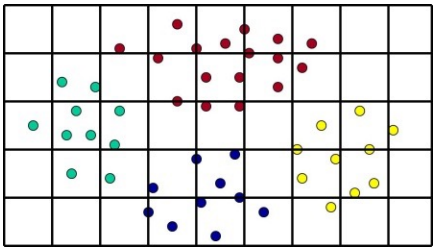
Analyzing medical studies with the highest level of accuracy is important for an optimal prognosis. With **g-COM Medical**, the customization of **g-COM** for medical predictions, the efficacy including side effects can be analyzed for different groups of similar patients. In contrast to existing approaches, the characteristics of these groups will not have to be predefined but are determined by a machine learning algorithm.

Doctors can now analyze the groups and their characteristics and use their medical expertise for explaining the behavior of each group. Based on this detailed analysis the effect of a drug can be predicted for patients with much higher precision than before.

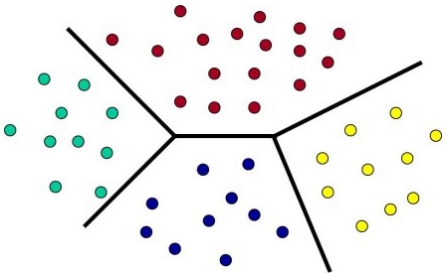
As an example, in a recent practical study, patients had to be classified according to their expected response to the medication. Using **g-COM Medical** relevant features of the data could identified. For instance, female patients in the age range from 30 to 40 and with a low body mass index (BMI) had an average response of 85% and a forecast of 80% – 90% (statistically significant with $p < 1\%$). In contrast, males between 26 and 35 years with medium BMI had an average response of 45% and a forecast of 42% – 48% (again with $p<1\%$).

Disadvantages of standard methods

Standard approaches typically employ pre-segmentation techniques that are based on the independent analysis of



Sparsely populated or empty cells



Significant substructures

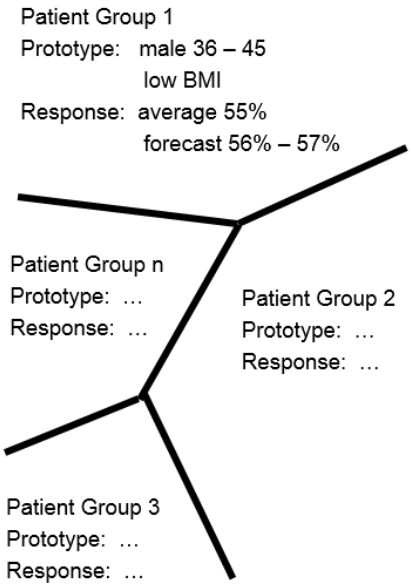
the influence of all relevant parameters. Geometrically, this leads to a dissection of the parameter space into boxes which contain more homogenous substructures that are then subject to statistical analysis. In the presence of a reasonably large number of parameter characteristics and specifications the generated cells are typically sparsely populated. Hence, quite often, an application of the law of large numbers is prohibited and different, more complicated and less reliable, statistical techniques have to be evoked.

g-COM: A change in paradigm

g-COM uses a reverse, data driven paradigm. Rather than imposing a simple dissection on the parameter space followed by complicated statistics **g-COM** computes an optimal clustering of this space and subsequently applies simple, meaningful and reliable statistics. Until recently such an effective and efficient application of this natural principle was out of reach due to the lack of an adequate mathematical model and fast algorithms for clustering of high dimensional weighted data, including nominal data, under all relevant problem specific constraints. While standard clustering methods are capable of determining rather homogenous structures efficiently, such additional constraints could not been incorporated appropriately. Further, standard methods are typically restricted to computing solutions that are merely locally optimal, while the new technique is capable of creating globally optimal solutions. **g-COM** therefore allows to gain new insight in the dependencies and interactions of all parameters for the respective application by allowing for a significant analysis of the clusters at optimality.

g-COM in a nutshell

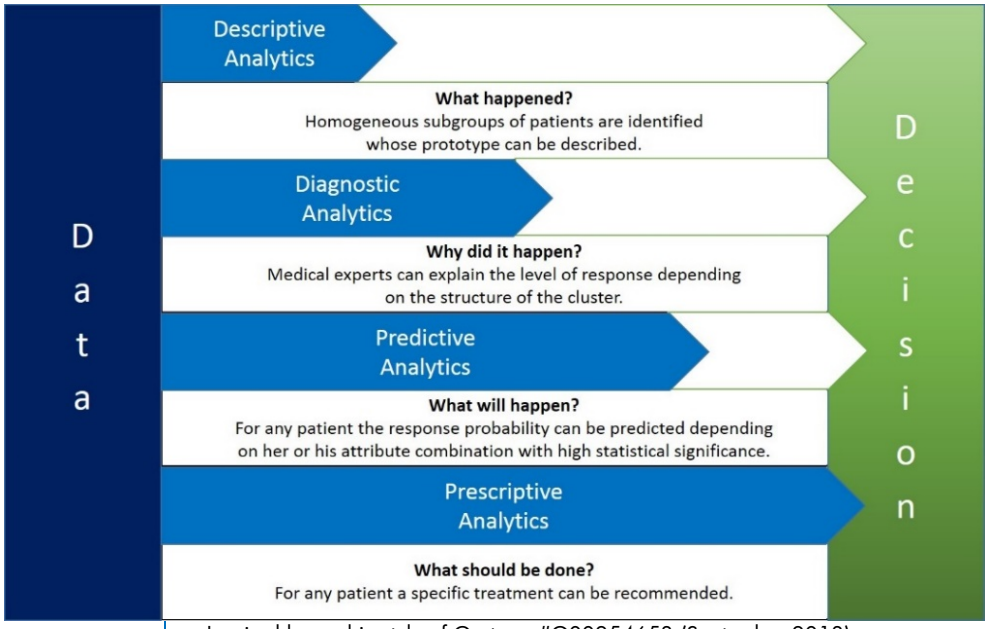
g-COM, the galor Cluster Optimization Model, first solves an application and data specific complex clustering problem with the aid of state-of-the-art and newly developed mathematics and software technology. **g-COM** thereby identifies homogenous substructures within the total body of data and performs a robust and statistically significant analysis of the multvariat interactions of all parameters. This is the bases of the **g-COM** prediction method which can then be used for the classification of new data.



Knowledge discovery with g-COM Medical

With **g-COM Medical** the typically inhomogenous population of medical studies is split into a small number of groups which behave very similarly with respect to efficacy of the medication under consideration. In contrast to classical sub-group analysis this multivariate approach guarantees the detection of large enough but still quite homogeneous populations so as to warrant significant results. **g-COM Medical** is able to determine representatives of the relevant grups and provide in depth analysis. Combined with the knowledge and experience of medical doctors this yields a completely new and precise way of interpreting and predicting efficacy of drugs. As it turned out in a recent study, it is the combination of the individual parameters that determine the optimal dose of an antidepressent drug. For instance, a European male of the age between 36 and 45, with a low BMI, a duration of two to four weeks of his current episode of depression, and a MADRS score of 30 at the beginning of the treatment should be prescribed a 25mg dose of a certain pharmaceutical ingredient to optimize his response. This is in striking contrast to a female, between 45 and 54 years old, also having a low BMI with a duration of her current episode of depression less than 7 days and MADRS score 45. Such a patient should be given an optimal dose of 15mg of a different pharmaceutical drug.

g-COM Medical within the realm of business analytics



Inspired by and in style of Gartner, #G00254653 (September 2013)

The key features of **g-COM Medical** can be described within the realm of the phase model of business analytics:

What happened? This task is performed by identifying and analyzing homogeneous substructures and their prototypes **g-COM Medical** reveals these structures in a form that is directly accessible by medical doctors.

Why did it happen? On the basis of the structural information medical experts gain new insight in the correlation between multiple attributes and the resulting efficacy of medication, potentially leading to new explanations for pharmaceutical responses.

What will happen? Based on the identified structures within the high-dimensional space of attributes **g-COM Medical** provides significant predictions for the success of individual medication. In fact, his attribute combination places a new patient into a reference group whose response is known with high accuracy.

What should be done? **g-COM Medical** can be used to recommend the best drug and optimal dose for a medication. Also, **g-COM Medical** detects the influence of attributes like the BMI and can lead to well-founded accompanying measures.

Unlike other methods, **g-COM Medical** does not function as a black box but allows for medical reasoning.

Are you ready to start a project?

To assess the potential of **g-COM** in a new field of application the following is needed:

- A short description of the application including the desired analytic goals;
- A list of the relevant parameters and their specifications;
- A representative set of test data.

General applicability

g-COM can be applied to a great variety of data analysis tasks in various business sectors. It has already been proven highly successful in the prediction of insurance loss, credit defaults, and air cargo demands.

Contact us!

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