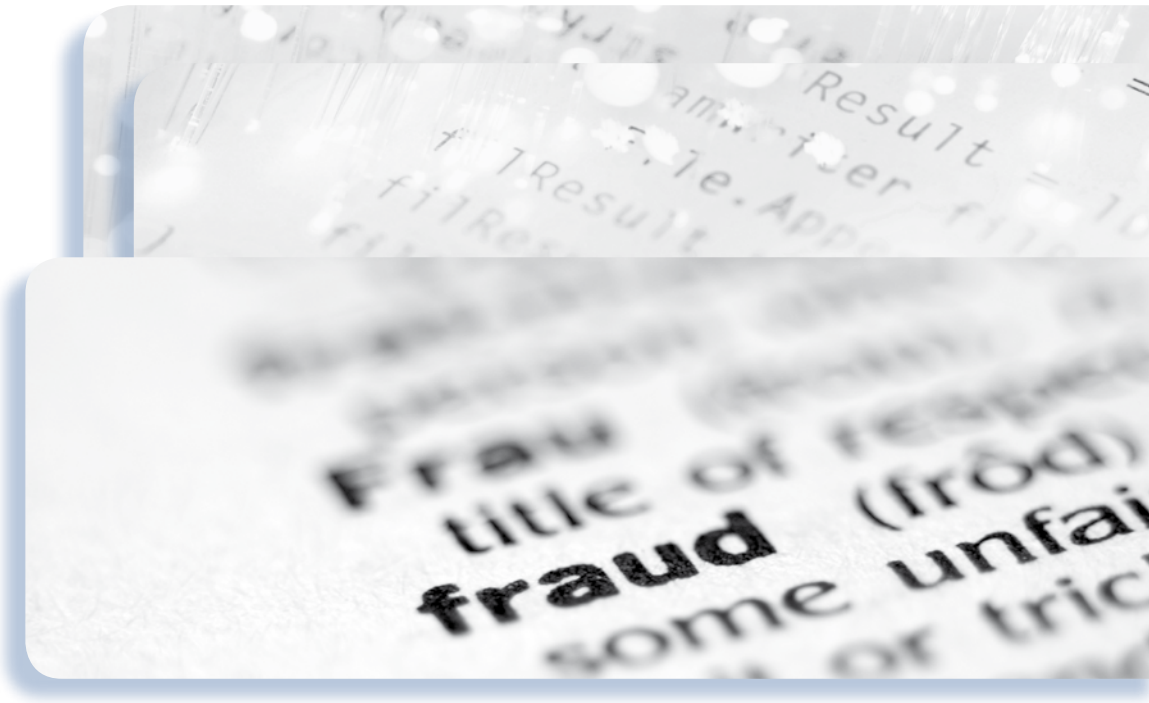
White Paper

The HUGIN FRAUD DETECTION MANAGEMENT (FDM) Solution



Prevent insurance fraud with advanced, predictive analytics from HUGIN EXPERT

White Paper

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HUGINEXPERT
The leading decision support tool

Fraud - an expensive and unrelenting challenge

Insurance companies in Denmark, Norway and Sweden now use the HUGIN FDM system:

- Fast, consistent claims evaluation
- Early identification of high-risk claims
- More detected fraud
- 25% hit-rate increase and reduction of false positives for improved SIU efficiency
- Fast ROI

Fraud costs the insurance industry billions each year. Insurance associations around the globe estimate that 10-20% of all insurance claims involve fraud, and that a significant portion of fraudulent claims continue to go undetected.

Insurance fraud takes place in all insurance areas and includes claim padding, falsified estimates, exaggerated injuries, double billing and fabricated accidents. Fraud forces insurers to pass on the high cost of fraud to their policyholders, which drives up the prices of premiums for honest customers.

Claims savvy and investigative leg work are essential to an insurer's anti-fraud efforts. However, as fraud schemes become more and more sophisticated, insurers must adopt new and more advanced detection methods and technologies to effectively combat the problem.

Implementing advanced fraud detection technology in claims is an effective way to identify potential fraud and abuse. With claims payouts and expenses accounting for a major portion of an insurer's expenditure, having an advanced fraud detection system in place can also provide insurers with significant cost savings.

This White Paper introduces the HUGIN FDM solution and describes how it can help insurers identify more fraud and improve claims handling efficiency for a stronger, more proactive defense against fraud.

THE HUGIN FDM - automated predictive analytics

HUGIN FDM is an advanced predictive analytics solution that provides insurance companies with automated fraud detection capabilities during claims handling.

The HUGIN FDM is a flexible plug-in system that can calculate the probability that a claim is fraudulent. HUGIN FDM can be implemented as an integrated traffic light system for real-time fraud identification.

In Figure 1 below the HUGIN FDM system is integrated as a traffic light on the screen of claims handlers. The traffic light indicates the likelihood that a claim involves fraud, enabling claims handlers to quickly prioritize claims as Fast Track, Regular Track or Requires Investigation.

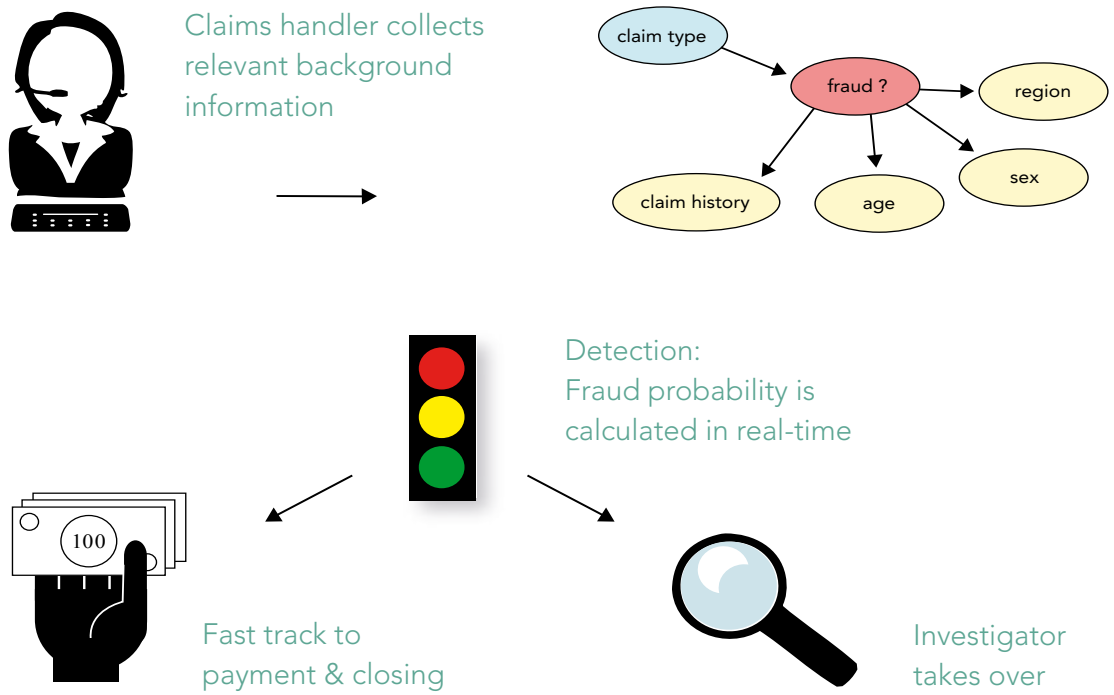

Figure 1: The FDM solution identifies claims for investigation

HUGIN FDM injects efficiency and consistency into the claims handling process, with benefits for customers and investigators as a result. The fast settlement of routine claims leads to increased customer satisfaction and customer loyalty. And when only claims with a high likelihood of fraud are sent to investigators, their hit-rate accuracy increases and they can focus on cases with the greatest potential of fraud – and savings.

HUGIN FDM - intelligent model-based decision support

The HUGIN FDM is based on Bayesian Networks, an advanced probabilistic graphical modeling technology. The fraud model is the central component of the HUGIN FDM. The fraud model specifies the relations of dependence between a fraudulent claim and fraud indicators such as customer behavior and customer attributes. The model also specifies the behaviors and attributes that distinguish a fraudulent claim from a legitimate one.

Figure 2 shows a fraud detection model that specifies the dependence relations between fraud, claim type, claim history, customer age, etc.

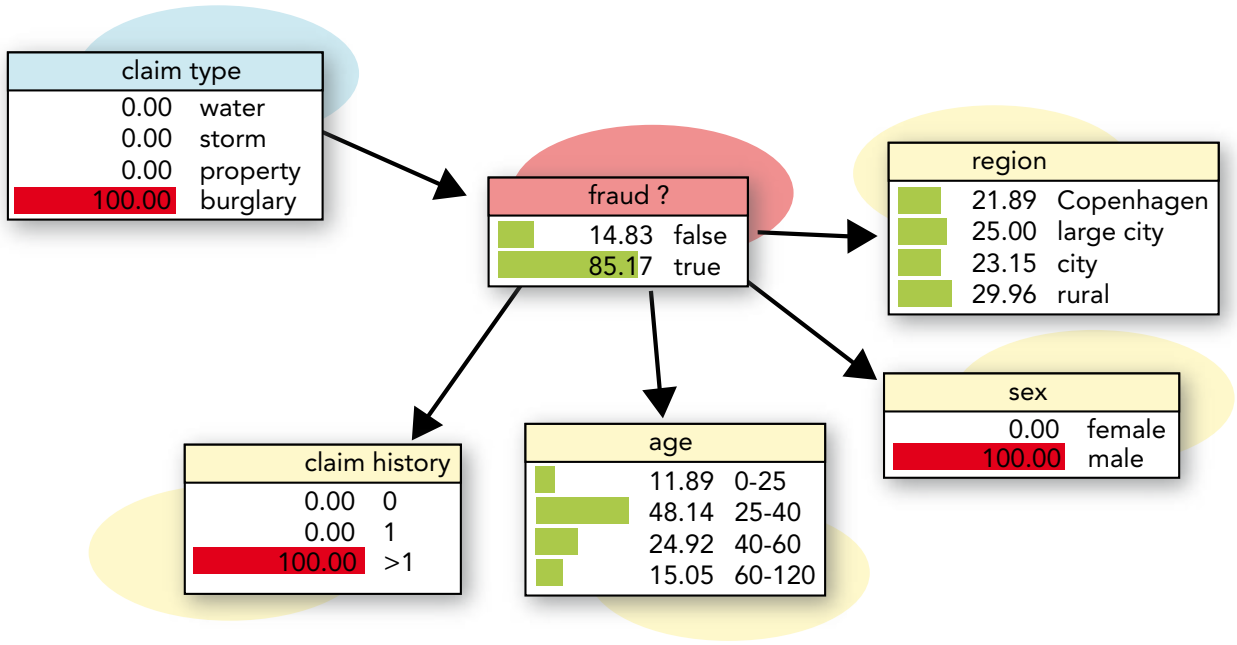

Figure 2: Fraud probability is 85.17% for a burglary claim made by a male with a history of more than one claim

In the case of a burglary claim made by a male with a history of more than one claim, the probability of fraud according to this model is 85.17%. Even with incomplete information the model can calculate the probability of fraud. In this case the given information indicates a high likelihood of fraud.

Key Features of HUGIN FDM

- Combines historical data and knowledge of experts
- Computes with missing observations
- Calculates fraud probability in real-time
- Trouble-free model integration and maintenance
- Intuitive, graphical communication tool
- Models are easy to adjust and extend

Flexible, intelligent analytics

One of the most unique advantages of the HUGIN FDM solution is its ability to combine multiple sources of information such as claims history, various fraud data and historical data with the less precise but intuitive knowledge of claims and fraud professionals. This flexible combination of data and knowledge, combined with the powerful algorithms underlying the software tool, produce accurate and optimal fraud predictions even when claims information is missing.

With HUGIN FDM it is possible to take advantage of the decision support capabilities on a step-by-step basis. This means that insurers need not build a complete solution in one go, but can extend their initial fraud models over time to include additional risk indicators and new claims information.

The solution can be developed using in-house resources after training in the HUGIN tool, and depending on data availability an initial model can be developed after only 1-2 days.

The intuitive graphics of the fraud model make it easy for analysts and claims professionals to communicate about fraud risk and the fraud model and its properties, and support a variety of methods for model and result analysis.

In the burglary case, given the information that the customer is a male with a claims history of more than one burglary, the operative observation is customer age. When customer age is between 25 and 40, the fraud probability of the claim is high. When customer age is over 60, fraud probability decreases to 33%.

In addition to this type of value of information analysis, sensitivity analysis can also identify the model indicator with the largest impact on the probability of fraud. In this case, sensitivity analysis reveals that the probability of fraud is most sensitive to the observation on claims history.

How to develop fraud models using HUGIN FDM

HUGIN is a data mining tool, but it is more than this. HUGIN can be used to construct models or "rules" from data only, or from a combination of data and expert knowledge. The feature of combining data and expert knowledge efficiently is unique to Bayesian Networks, the technology behind the HUGIN FDM system.

A fraud model integrates various knowledge, information and data sources into a single model representation of fraud prediction. A model is constructed based on a set of training data, and can be continuously updated to reflect changes in the domain, such as changing correlations between age and the likelihood of fraud.

Insurance companies often start with a simple model and then extend it as new knowledge is generated. This could involve adding or removing indicators from the fraud detection model based on experience, or data analysis performed using HUGIN software.

The first step of the model development process is to identify fraud model variables and their dependence relations. Figure 3 illustrates the structure of a simple fraud detection model.

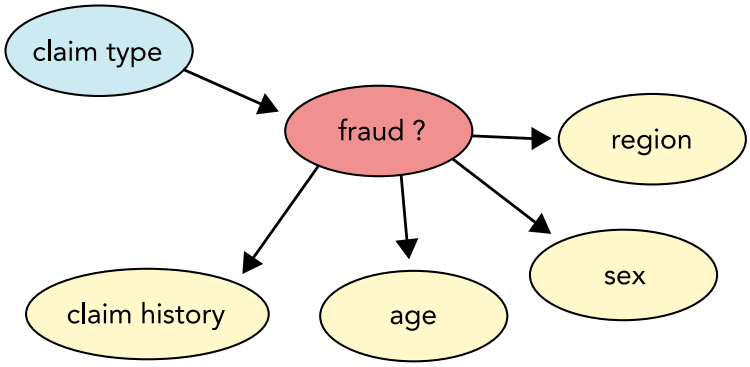

Figure 3: A simple fraud model and the dependence relations between fraud and claims history, age, etc.

The model consists of six variables, the variable of interest being **fraud?** The purpose of the model is to compute fraud probability based on observations and other variables that may or may not be known about the customer making the claim. The graphical structure of the model specifies the dependence and independence relations between the variable pairs, and the model arrows often indicate cause-effect relationships.

Figure 4 illustrates the quantification of the dependence relations between a fraudulent claim and customer age. The probabilities communicated by the model can be assessed by subject matter experts, estimated from data or a combination of the two.

Fraud	False	True
Age 0 - 25	0.17	0.11
Age 25 - 40	0.03	0.56
Age 40 - 60	0.13	0.27
Age 60 - 120	0.67	0.06

Figure 4: Quantifying relationships - Here between age and fraud

The same model used to support fraud detection can also be used to support fraud investigation. The model can be used in real-time to assess the probability of fraud in a particular case, to analyze the properties of fraudulent cases, etc.

HUGIN FDM architecture and system integration

The HUGIN FDM software package consists of a Decision Engine, an easy to use graphical user interface (GUI) and an API for integrating HUGIN functionality into other applications.

The HUGIN GUI supports domain experts in the model development phase. Figure 5 shows an example of the HUGIN GUI.

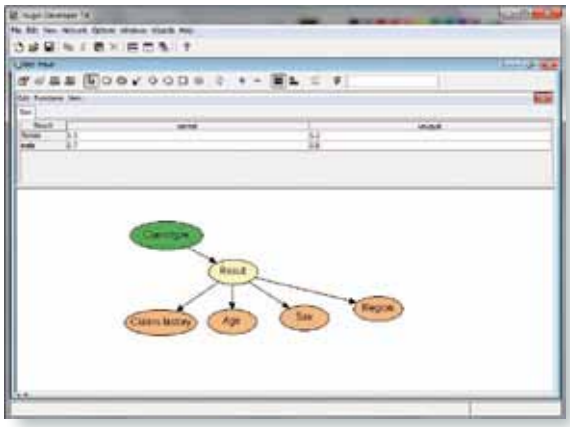

Figure 5: HUGIN Graphical User Interface showing a fraud model

One of the major advantages of HUGIN FDM is how easily it can be integrated into new and existing claims environments. HUGIN Application Programming Interfaces (APIs) make the system integration process simple and efficient. Figure 6 illustrates the typical setup. Model development proceeds on standard PC platforms using the HUGIN GUI. Each model is stored in an ASCII text file, which is then transferred to the production system. On the production side, existing IT systems interact with the model through the HUGIN API, feeding information into the model and receiving results of the inferences.

System maintenance and model updates are separate processes. Once system integration has been accomplished, it is easy to carry out model updates. Given the same set of input and output data, updating a model consists of replacing a single ASCII text file. This enables domain experts to adjust a model without requiring the support of IT.

System Highlights

- User-friendly graphical knowledge engineering tool
- Highly efficient inference engine
- Integrates easily into existing systems
- Easy to extend, modify, implement and maintain
- Flexible, scalable technology with sophisticated analytical tools
- Flexible Application Programming Interfaces for the major programming languages: C, C++, Java, .NET and VBA

The HUGIN Decision Engine is the muscle behind the FDM system. Based on breakthrough algorithms discovered by a Danish research team, the HUGIN decision engine is widely recognized as one of the most efficient and robust inference engines on the market.

The HUGIN Decision Engine comes with APIs for major programming languages enabling the easy integration of HUGIN into new and existing IT systems.

HUGIN software has been implemented on wide range of software and hardware platforms including servers, desktop & laptop PCs and PDAs running on Microsoft Windows, UNIX and Linux operating systems.

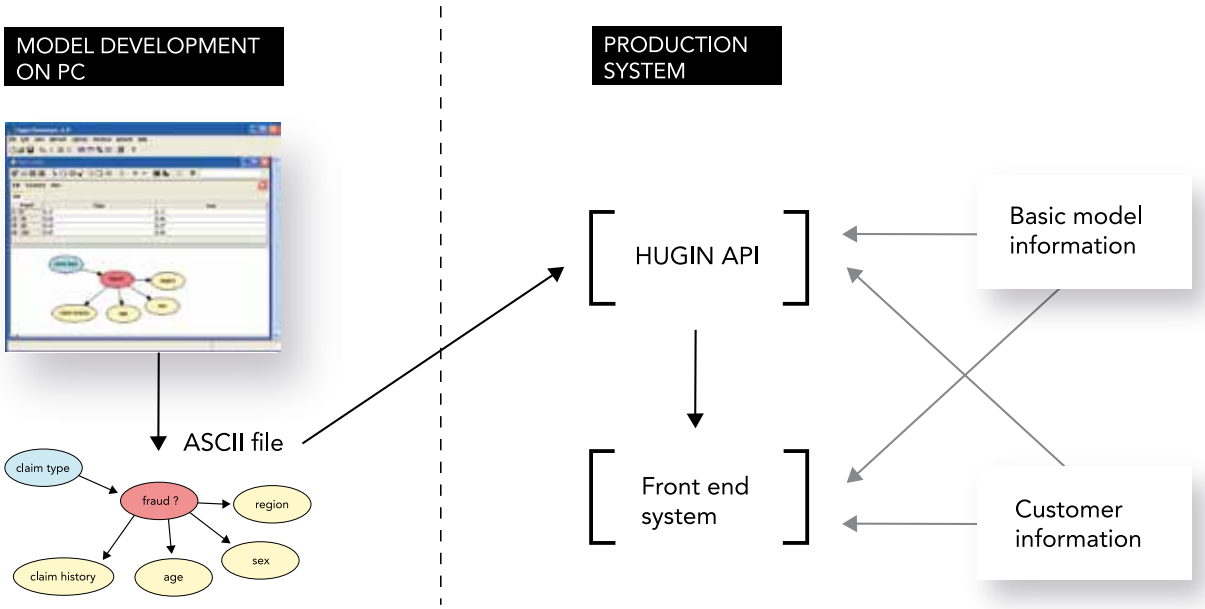

Figure 6: Simple and efficient system integration

FDM development and implementation process

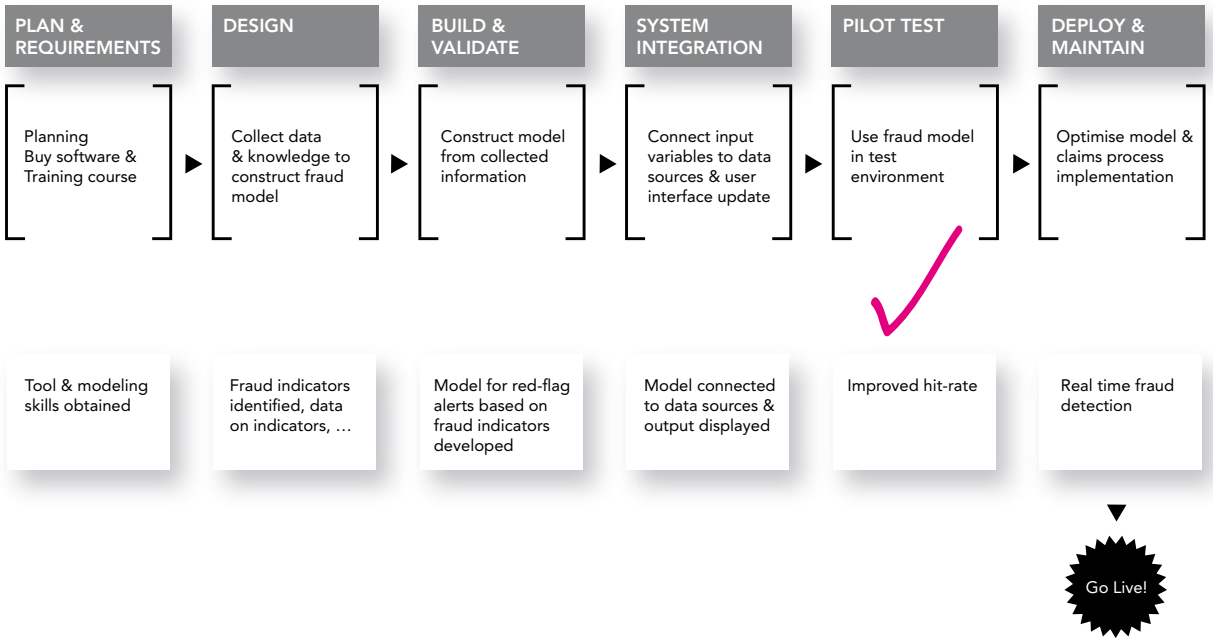

Figure 7: HUGIN Fraud Detection Management solution for automated detection of fraudulent claims

HUGIN consultancy and training

HUGIN EXPERT provides a complete package of products and services needed to develop and integrate a HUGIN FDM model into an existing IT platform.

Fraud model development is usually carried out by analysts on the basis of data and expertise provided by claims handlers and investigators, and model integration by IT professionals in the client organization.

To support model development and integration, HUGIN EXPERT offers a general 3-day training course as well as on-site training in the HUGIN tool. Participating in a general training course provides analysts with the skill set needed to develop sophisticated fraud detection models, and to integrate them into various IT environments. The training course also provides the skills necessary for a client to adjust and extend existing models and develop new models specific to their IT platform.

HUGIN consultants have solid experience helping insurers develop and integrate FDM models, and on request HUGIN EXPERT can assist the client with technical support in one or all steps of fraud model development and integration.

About HUGIN EXPERT A/S

HUGIN EXPERT A/S develops advanced decision support analytics for reasoning and decision making under uncertainty. Based on complex statistical models called Bayesian Networks, our software is used to develop decision support systems in a wide range of application areas such as fraud detection, credit risk evaluation, forensic identification, operational risk management and trouble shooting.

For over 20 years, international clients and Fortune 500 companies have used advanced predictive analytic software from HUGIN to turn business data and expertise into intelligent knowledge management solutions for smarter and more efficient decision making.

Some of our customers

CODAN, Trygg-Hansa, Nykredit, Himmerland Forsikring, NEM Forsikring, CM-CIC, Targo Bank, Bradesco Bank, UniBanco, Pensam, National Australian Bank, OCBC Bank, Banca Populara De Sondria, Deloitte, Daimler-Chrysler, Siemens, Volkswagen, Astra Zeneca, Boeing, HP, Lockheed Martin, KCC, NASA, P&G, Sandia, Sentrana, Motorola, BBC, DSTL, Rolls-Royce, Shell, Unilever, Chevron-Oronite, Mitsubishi, Toyota, Toshiba, EWOS, DNV, Farvandsvæsenet, Københavns Energi, SSPA, Samsung, GSK, COWI, DSTL

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