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Crisis and Innovation

The current world-wide economic crisis is very destructive. We all agree on this. What to do to solve the problem is a hot potato...

We believe that government spending packages are generally wildfires that will burn quickly to mask the problem and reveal greater damage at a later point. The reason is that these packages do not attack the root cause.

The cause of the crisis is that many of us have lived beyond our means. To solve an overspending problem by artificially increasing spending seems a sub-optimal solution. We can rid ourselves of this root cause only by inventing new technologies to shift the balance of the financial flow.

It is possible to produce basic goods for less money so that we can get what we need without spending as much for it and thus living nicely while being able to afford it.

How to produce more for less? A combination of NEMO and OMEN, innovative technology made by algorithmica, can do it.

algorithmica wins Innovation Prize IT by Technology Ministry

The German federal Ministry of Economy and Technology together with the Initiative for Small and Medium Sized Enterprises has awarded this year's Innovation Prize IT to algorithmica technologies for its product OMEN.

Over 2000 IT products from all over Germany competed for this prestigious award. Based on criteria such as the degree of novelty, the technological sophistication and the economic potential both for the producer and the client were the main criteria for selection.

OMEN is a tool that models and optimizes a process from the process industry. Such a process can be viewed like a black box in which we put some raw material and out of which we take some final product. The box also has a number of dials on it that control what it does. OMEN looks at the inputs, outputs and dials and uses this information only to learn what the process does.

On this basis, OMEN constructs a mathematical model of the process and is able to compute the best possible setting of the dials at any point in time – relative to fixed outside influences and external boundary conditions – in order to achieve the optimal operational point. This optimal point is usually defined by the yield of the process.

In this way, OMEN can improve the yield of a standard process by 3 – 5% without modifying the plant in any way.

This approach is definitely novel. There is no competition that proposes the same form of modelling. Other approaches require significant participation of the process engineers and this workload drives up project costs and time. OMEN is able to learn a process using historical archive data only and it can do this in just a few days of computation time.

To do this, we use research grade mathematical methods that push the envelope of state-of-the-art. The main area of research for us is machine learning – the science of how to teach a computer what to do based on historical examples of what has been done.

We have demonstrated the successful deployment of this approach with a variety of process industry clients. This demonstrates that this approach is applicable in practise.

The client can optimize the process without capital investment, without plant modification, without significant time involvement and he can expect to receive substantial gains in yield. A positive side effect is the relative reduction in CO2 emissions achieved by higher yield of the same plant.

These arguments have satisfied the Ministry to recommend OMEN to the industry as the way forward in production technology.

Active Applications

AT is constantly pushing the envelope in the development of state-of-the-art technologies to solve practical problems. Applications for public funding and prizes occupy an essential place in this endeavour.

We have teamed up with a variety of high profile organisations to get sponsored R&D projects.

Factory Planning

A factory is essentially a building with machines in it. These machines are connected in some fashion and people have space in which to work. Where the machines go, where the people work, how the building is constructed and how the material flows through the process must be planned before the factory is built.

This planning is typically done manually over one or two years by a team of people and thus quite costly. By specifying the boundary conditions and a desired output (e.g. maximal throughput), a computer model can be created and thus an automatic optimization run on this model.

The result is an automatically planned factory that is better than any manually planned one. The process to accomplish such a plan would take only 3 – 6 months and so save considerable costs.



Reduce CO2 Emissions in Power Plants

The CO2 consumption of a power plant is a direct measure of the plant's efficiency and its environmental footprint. It can be reduced to a minimum using OMEN ...

Many governments have started to charge emitters of CO2 a fine – referred to as an emissions certificate – for releasing CO2 into the environment. In order to reduce this, fossil fuel power plants have started to focus on methods to improve efficiency. OMEN is a very effective tool for this purpose.

There is nearly universal agreement that we are experiencing a radical shift in climate worldwide, that this is caused by humankind and that our release of CO2 into the atmosphere is a major component of this effect.

In order to reduce the severity of the change, governments worldwide have agreed to reduce the level of CO2 emissions.

Most CO2 is emitted in the conversion of fossil fuels into energy. For instance coal or gas power plants and car and airplane fuel are the main contributors to this effect. Many believe that market forces can govern this process best, i.e. when CO2 becomes a financial cost, then environmental protection becomes an asset.

In this way, the existence of CO2 certificates is justified. The fine is charged per metric ton released but the fine is not a constant – a certain minimum number of certificates are free, if more or less are actually needed, these can be

be traded on public commodity markets. Thus the price of a ton of CO2 is volatile and instruments of financial risk assessment come into play. In Europe this instrument is now well established and understood by its players.

In order to improve operations, the CO2 emissions must be reduced. As the amount of CO2 contained in a certain quantity of fossil fuel is constant, this means that we must increase the conversion efficiency.

For a given supply of fossil fuel, a given power plant and given external conditions, we must therefore be able to determine those settings of the plant's inputs that give rise to the greatest efficiency.

The traditional way to do this is to consider each machine on its own, improve its efficiency and multiply all the machines' efficiencies into an overall equipment efficiency (OEE) for the plant.

This approach is very intensive on people's time and is thus very expensive. Also possible improvements on the interfaces between machines are necessarily ignored by this process. A holistic way of looking at the plant is

required to meet the need of *optimal* operations. Looking at the problem bottom-up has simply not solved the problem. A top-down approach is needed but this cannot be done by humans because the complexity is just too great.

OMEN can save more CO2 than engineering solutions

Optimally running a plant with hundreds of mutually inter-dependent inputs in response to dozens of external conditions – ranging from weather to consumer demand is an impossible challenge to the operators.

It is possible to construct a full process model merely using measured data from the plant's control system. This model will contain the complete knowledge of historical operations including all correlations and dependencies.

Using this model, optimization methods can quickly and reliably locate the best setting with respect to plant efficiency. Based purely on data, this method is objective, analytical, fast and economical – it also does not tie up the experts and leaves them free to improve the plant via engineering.

The best part is: The plant's efficiency can rise by several percentage points without any capital investment.



Plans for Next Quarter

1. We have become clients of the Houston Technology Center – a highly reputed technology scout agency set up by the energy industry in the USA, located primarily in Houston, Texas.

We will use this newly generated resource to market our products with the gulf coast's corporations. The focus will lie with chemical plants, oil refineries and power plants.

Our goal is to obtain one USA client by the end of 2009, who is willing to test our products and attest to its value. We are confident that we can meet this challenge and successfully expand into the North-American market.

2. The financial crisis has led many industrial players to radically reduce production; some have even stopped it entirely. The demand from the automotive industry has plummeted most of all and so chemical plants have felt the full force of the crisis. Power plants are much better off as they also sell to consumers who depend upon electricity.

We have thus switched our main focus for the time being to market to the power producing and oil refining corporations.

There are some chemical corporations that now have the time to think strategically and these are, of course, priorities as well.

3. We are planning our own strategic growth for the next year in which we want to expand due to our recent success in demonstrating our products. We anticipate growing demand and thus a growing need for products and services.

Thus we are searching both for investors that can accompany us on our journey as well as experts who would like to help us shape the technology of the future.

Goal-oriented data analysis is the key to achieving the next-generation of productivity gains. As the "low hanging fruits" are all picked, there is no other way around the sheer complexity of the problems still facing us.

What is ... machine learning ?

Humans generally learn by accumulating examples in various categories. This is how we learn similar from different. After a sufficient number of examples are experienced, we are suddenly able to generalize to so-far unseen examples. At this moment, we have "learnt" whatever the examples were of.

The method by which the human brain assimilates the examples into a model that is capable of generalization is unknown at the moment.

The branch of mathematics and computer science known as *machine learning* attempts to create an algorithmic form of human learning.

The computer is presented with a number of examples for something, just as a human learner would be. It is also given a method by which to condense these examples into a form suitable for storing generalizable knowledge. After the processing is done, we have this generalized representation of the learned examples.

Now the quality of the learning is tested on examples not yet seen and, if necessary, more examples are provided – just as a human would do it by giving more lessons.

Generally, machines need more examples and generalize less than humans but they do it very quickly and economically.

EYE ON IT

Clients / Partners :

- Aluminium Norf GmbH
- Bayer Technology Services GmbH
- BP Global Solutions ^{NEW}
- EADS N.V.
- EVONIK degussa GmbH
- Fraunhofer-Institut für Fertigungstechnik und Angewandte Materialforschung
- Infracor GmbH
- Institut für Internet-Sicherheit
- METRO Cash&Carry Deutschland
- mobile solution group GmbH
- Momentive Performance Materials Inc.
- National Aeronautics and Space Administration
- nicos AG
- Rhenus Lub GmbH & Co KG
- Rieter Automatik GmbH
- RWE AG
- Ryanair Ltd.
- SASOL Solvents Germany GmbH
- Tchibo direct GmbH
- Technologie-Zentrum Informatik
- ZF Friedrichshafen AG
- T-Systems Enterprise Services GmbH
- TUI AG
- TÜV Rheinland Group
- UNI Dai-Ichi Shoji Co. Ltd.
- Vattenfall Europe Berlin AG&CoKG ^{NEW}
- VESTOLIT GmbH & Co. KG
- VHV Vereinigte Hannoversche Versicherung a.G.
- Volkswagen AG
- Volkswagen Plant Salzgitter



Professional Development

Do you want a challenge?
We constantly seek bright people to add to our team of expert problem solvers. We offer internships, trainee programs, part-time & full-time professional employment. Contact us and experience working on state-of-the-art solutions within a friendly team.

Upcoming Events

• Houston Technology Center

07.-13.02.2009

This event brings together leading process industry decision makers to Houston, Texas. algorithmica will be present to make its value offering known. Please get in touch with us for a private meeting during the forum.

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