Hands-on Experiences in Building AI Solutions for Industrial Use

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At your service

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TOP data science

About Top Data Science

- Business : "AI as a Service"
- Located in Helsinki, Finland
- 20 people (16 data scientists with MScs and PhDs)
- Excellent customer track record
  - Finland, Germany, Denmark, Japan, Vietnam, Israel, USA
- 60+ machine learning solutions delivered
- Part of Morpho Inc. (https://www.morphoinc.com/en) since 2018

Customers & Partners


About Morpho

- Business : “Image Processing Software Licensing”
- HQ in Tokyo, Japan
- More than 3 billion licenses sold worldwide
- Listed in Tokyo Stock Exchange (TYO: 3653)
- 30+ image processing products & technologies
- Experts in on-device computation

Customers

HUAWEI

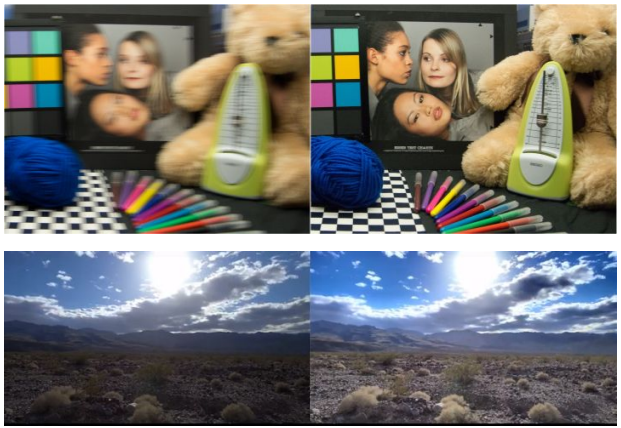
DENSO

QUALCOMM®

LG

SAMSUNG

Products



Solutions

Aiya – Process optimization

Aiya Process Optimization Solution is a modular, high-performing AI-based solution that is used to optimize industrial processes and production lines by predicting process performance and output

Computer Vision Applications

Application suites support wide range of demanding use cases for

- Industrial Process Monitoring & Quality Control
- Human Activity Detection & Analysis
- Traffic and Transportation
- Medical Imaging

Smart Search & Document Intelligence

Advanced tools for finding and retrieving information from various data sources. Multi-modal approach combining Natural Language Processing (NLP) and Computer Vision technologies.

Customized Problem Solving with AI

We have created wide range of customized solutions with consultative services. Solutions utilize different AI technologies depending on the problem area and customer needs.

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Co-creation

Top Data Science co-creation model brings together **customers' domain knowledge and our AI know-how** to build up innovative, robust and scalable solutions.

The industries that we have co-created and deployed AI solutions include:

- Pulp & paper and packaging
- Wide range of process industries
- Engineered product and component industries
- Health care & health tech
- Traffic management and transportation
- Biotechnology and pharmaceuticals
- Public sector

Scientific Approach

- **The scientific mindset** is key part of Top Data Science company culture and genetics.
- Active participation in AI-based innovation contests and ecosystems with constant curiosity in thinking novel ways to solve customer problems with state-of-the-art machine learning solutions.
- Providing excellent learning environment for team members through challenging customer projects
- **Continuous follow-up of AI tech scene** and related **knowledge-sharing** is a natural team behaviour and critical part of our success.

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Co-creation for Customer Success

Top Data Science has successfully executed over 60 AI projects with our customers from very domain specific research oriented R&D projects to robust and scalable software solution deployments.

"Top Data Science has been working closely with GE Healthcare's own data science teams to solve problems like spotting which patients in the intensive care unit are likely to deteriorate. Co-creation is the most important aspect of this collaboration. GE has deep engineering knowledge and partnerships with hospitals helping to validate the results during the development"

Erno Muuranto
Managing Director, GE Healthcare Finland

"Top Data Science has demonstrated very good AI competence and also a very flexible attitude in our cooperation. They have the right attitude to working together with customers for problem solving with AI."

Rashmi Kasat
VP, Head of Digital Biz Development, Digital Garage, Metso

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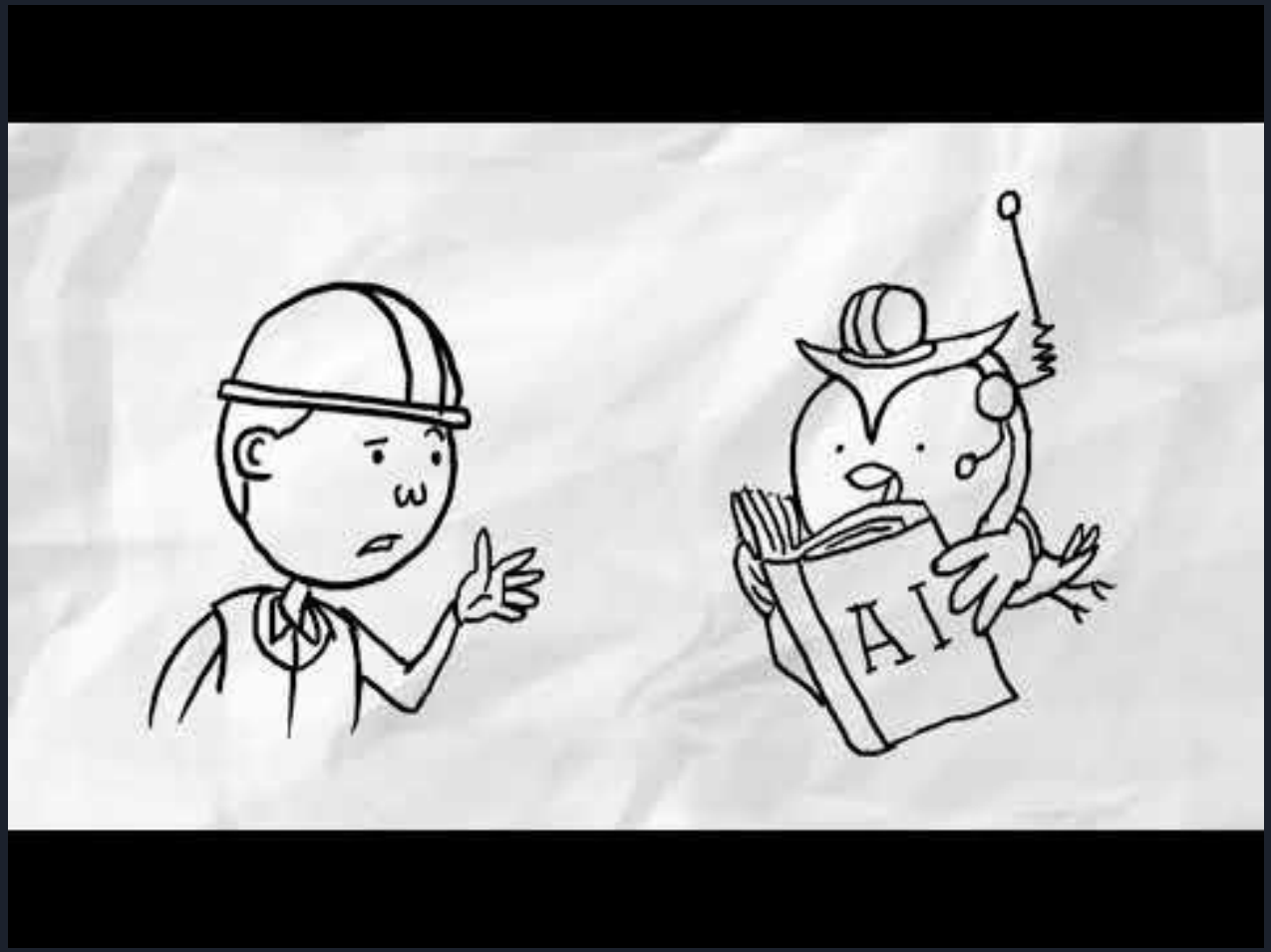
Case 1: Process Optimization with Stora Enso



CLICK THE IMAGE FOR THE VIDEO!

Aiya – Predictive AI for Industrial Processes

Aiya is a customizable AI application for predicting, simulating and optimizing industrial processes.

Aiya is a platform agnostic application deployable on any platform, for example Azure or AWS.

Typical applications are related to quality and/or cost optimization. Reference customers for Aiya include *Stora Enso* and *Novozymes*.

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Aiya Overview

Aiya is a AI solution to predict, simulate and optimize quality parameters for Industrial IoT processes.

- Aiya uses data from hundreds or thousands sensors to build predictive models.
- Aiya predicts quality parameters precisely hours in advance, supporting preventive actions to avoid from deviating from optimal production
- Aiya simulates quality parameters when users are changing the input parameters, helping users to find out the impacts of inputs parameters to the outcome products.
- Aiya optimizes the process and provides optimal sets of input parameters for the process to produce highest quality products

Customer benefits

- Minimized costs through optimal usage of raw materials and chemicals as well as production capacity
- Minimized risks and downtime through improved visibility, transparency and control
- Optimized product quality through enabled prediction and forecasting of process outputs
- Improved process control with accurate predictions

Case 2: Material Strength Prediction with Betolar

Formula recommendation tool for Betolar

Customer:

A start-up producing geo-polymers from waste streams

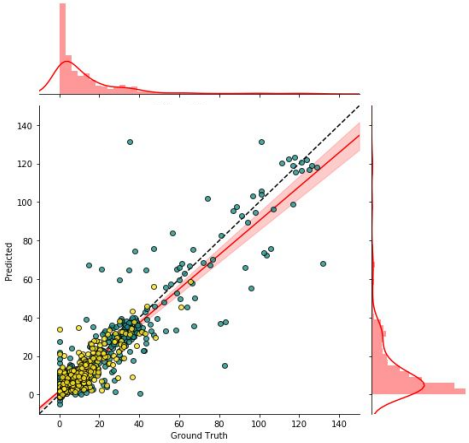
Tasks:

1. Modeling of property of interest with given ingredients
2. Formula optimization given constraints on **ingredient amounts and total cost**

Deliverables:

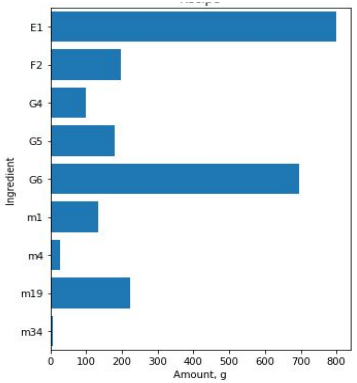
1. High accuracy model
2. Formula recommendation algorithm
3. Web application

Task 1: Modeling



Task 2: Optimization

Formula



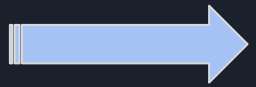
Computer Vision Solutions

Background and vision

★ Customers are targeting for ***more autonomous operations*** by using AI video analysis and computer vision technologies.

Video cameras and screens are widely used in mills, but still today they are observed manually & passively tieing operators to the control rooms.

TODAY VS. FUTURE VISION

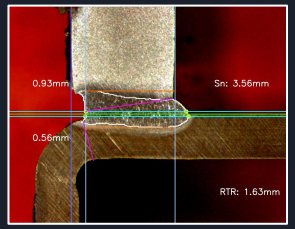


Adding AI driven computer vision to the video platforms can lead to a significant cost savings and benefits including:

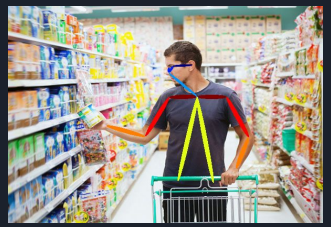
- **Automatic alarms and early-warnings**
- **Instructions and information to new operators and personnel**
- **Autonomous reactions on process changes & malfunctions**
- **More reliable operations and less downtime**
- **Free operator personnel from control rooms**

Our Computer Vision Solution Framework

Customer value through dedicated applications







High-end, productized AI capabilities

Fast and flexible solution creation from problem statements to deployment

Real-time inference and edge processing

Classification	**Detection**	**Semantic segmentation**	**Temporal/Time series**
Image classification	Bounding box object detection	Semantic or instance segmentation	Detection or classification for videos

Pre-built AI packages to be used as a basis for customer solutions

Technology Foundation

Morpho Imaging AI / Edge AI	State-of-the-Art Computer Vision technology and problem solving know-how	Optimal utilization of latest AI / ML technologies

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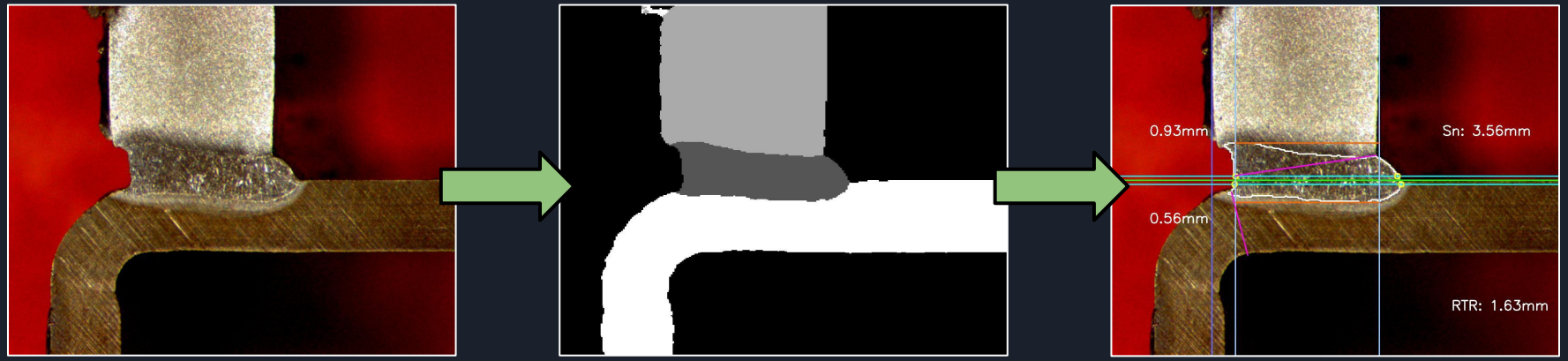
Case 3: Weld Seam Quality Inspection in Automotive Industry



Outcome : On par with human experts

Natural Language Processing (NLP) Solutions

Our Approach

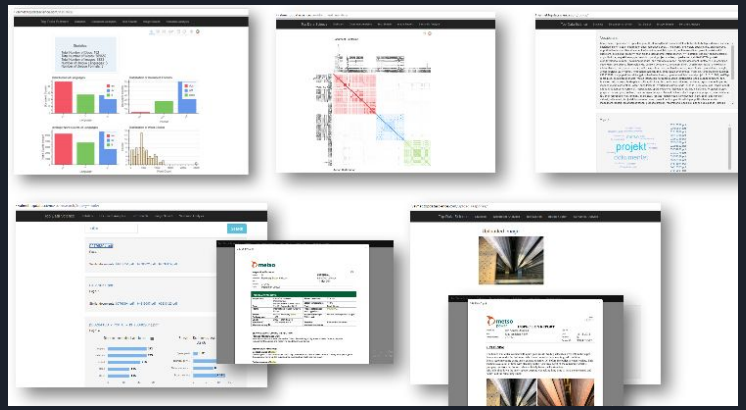
- Our Smart Search and Document Intelligence solutions are built on our deep learning driven NLP and NLU know-how. These technologies enable utilization of both semantic and contextual information for re-structuring the data storages, and building up high-performance search functionalities.

- NLP-based search applications are complemented with Computer Vision capabilities, like Optical Character Recognition (OCR), to extract and search textual data from image and video documents.

- Machine Learning algorithms behind our smart search employ active learning to enable continuous improvement of search results based on user feedback.

Case 4: Smart Search & Document Intelligence

Client is a Finnish industrial machinery company focusing on providing technology and services for mining, aggregates, and oil and gas, recycling, pulp and paper and other process industries.



%40 reduction in time for responding to incoming technical tickets.

Successful Deployment of AI

The Obvious

- Avoid trying to solve a problem that doesn't exist
- Get your data ready – properly curated and documented
- Gather a team of variety of skills
- Scope down

Executive-level Commitment

Pulp & Paper Production Optimization

Knowledge Transfer

Explainable AI

From Proof-of-Concept to Production

Proof of Concept

- Scoping and understanding the problem
- Define clear KPIs for PoC
- Select the most suitable AI approach and test the solution with available data set
- Create a clear plan how to pilot and scale

Pilot

- Develop the end user application and deploy the solution in run-time environment (cloud or on-premise)
- Improve the performance of algorithms
- Collect feedback from users and develop accordingly. End user acceptance is crucial!

Production

- Scaling the solution to new production lines / sites
- Improvement of algorithms and applications based on customer feedback
- Continuous performance monitoring

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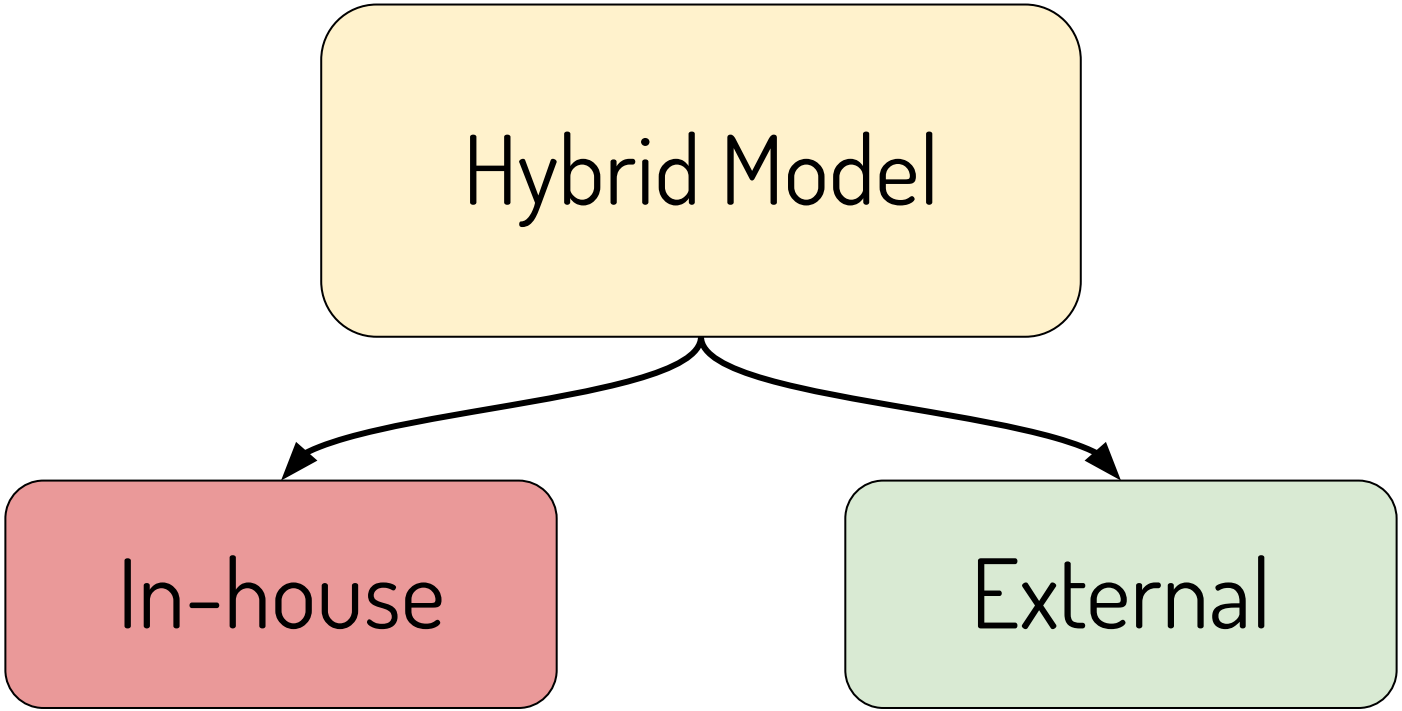
The whole is greater than the sum of its parts

Aristotle

Data Science projects are fundamentally different from traditional software development

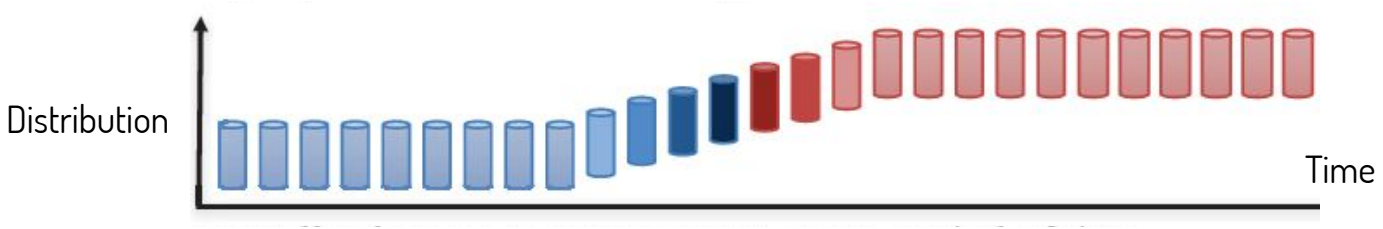

Hybrid Model
In-house
External

Open Source & Analysis Paralysis

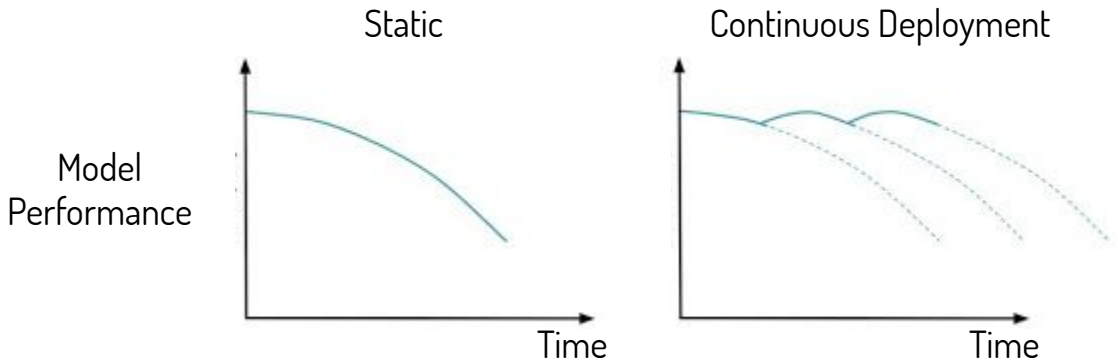
Hyperparameter Optimization libraries in python

- optunity
- hyperas
- auto-sklearn
- hyperopt-sklearn
- TPOT
- spearmint
- Ray Tune
- autokeras
- nni
- sherpa
- bbopt
- optuna
- hyperparameter_hunter
- talos
- auptimizer
- hypertunity
- scikit-optimize
- SMAC3

A Crucial Phenomena: Concept Drift



change of statistical properties of variables over time - typically in unforeseen ways.



A surprisingly difficult problem:

to update the production ML model or not

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