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Big Data Research at VTT

Svenska Tekniska Vetenskapsademiens årsmöte 28.3.2017

Prof. Caj Södergård

”Data is the world´s great new natural resource. What steam power was to the 18th century, electromagnetism was to the 19th and fossil fuels to the 20th… data will be to the 21st.”

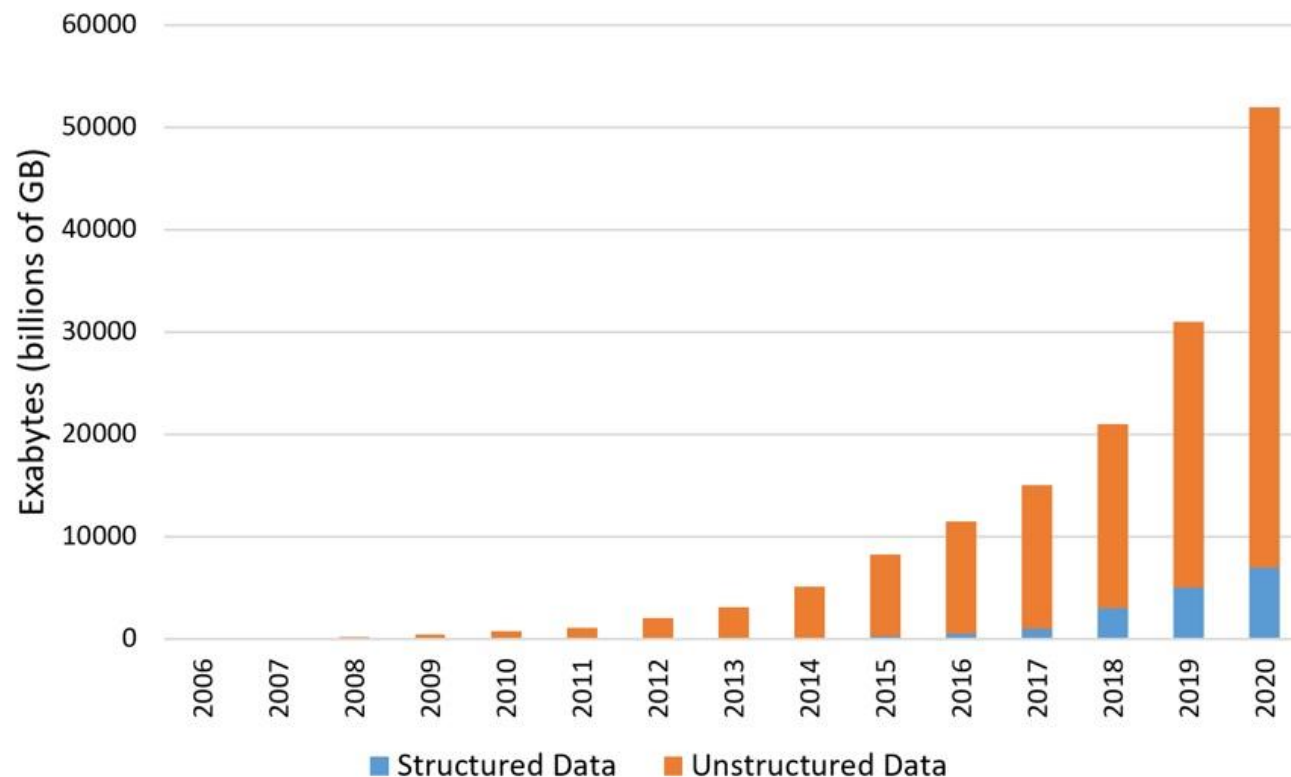Ginni Rometty, President and CEO of IBM

What is Big Data ?

3V

- **V**olume

- **V**elocity

- **V**ariety

- **(V**eracity, **V**alue**)**

The Cambrian Explosion...of Data

Exabytes (billions of GB) — years 2006 through 2020, showing Structured Data and Unstructured Data.

Source: Patrick Cheesman

Digital data grows at an annual growth rate (CAGR) of 42% until 2020 (*source IDC*)

HOW CAN BIG DATA MAKE A DIFFERENCE?

DO YOU KNOW?

Decoding the human genome took

in 2003 → **10 Years**

today → **less than a WEEK**

near future → **a few HOURS**

ALL OF THIS IS POSSIBLE BECAUSE OF

High speed broadband

Cloud services

High-performance computing

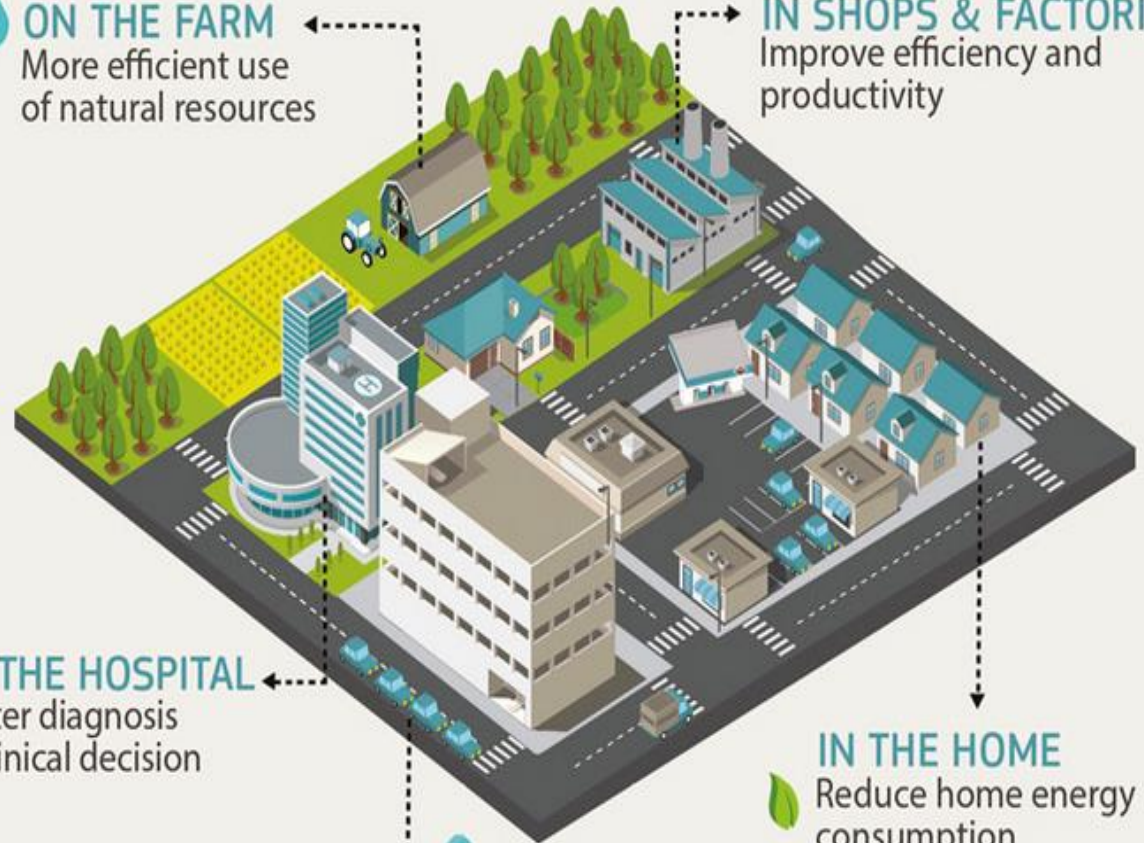Data analytics tools and methods

REAL LIFE APPLICATIONS

ON THE FARM
More efficient use of natural resources

IN SHOPS & FACTORIES
Improve efficiency and productivity

IN THE HOSPITAL
Better diagnosis & clinical decision

ON THE MOVE
Management of traffic flows

IN THE HOME
Reduce home energy consumption

Source: EU

Data-Driven Bioeconomy

- *Bioeconomy*: The utilization of raw materials from **agriculture, forestry and fishery** for food, energy and biomaterials with responsibility & sustainability

- Large quantities of data from
  - farm & forestry machines & fishing vessels
  - satellite & air imagery and local sensors

  About
  - soil, microclimate, trees, plant diseases, sunlight
  - marine environment

- *DataBio shows the benefits of Big Data in the raw material production for the bioeconomy industry*

- EU H2020 Lighthouse. Duration 2017 - 2019, Volume 16,2 M€, 48 partners, 71 associate partners

- VTT biggest partner and Technical Manager

04/04/2017

Source: Södergård, C., BDVA ESD Workshop, 21 Sept. 2016, Barcelona.
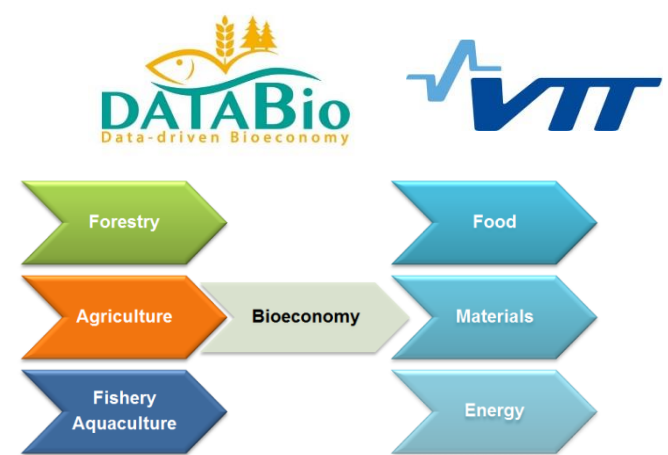
Estimating forest cuttings from satellite images
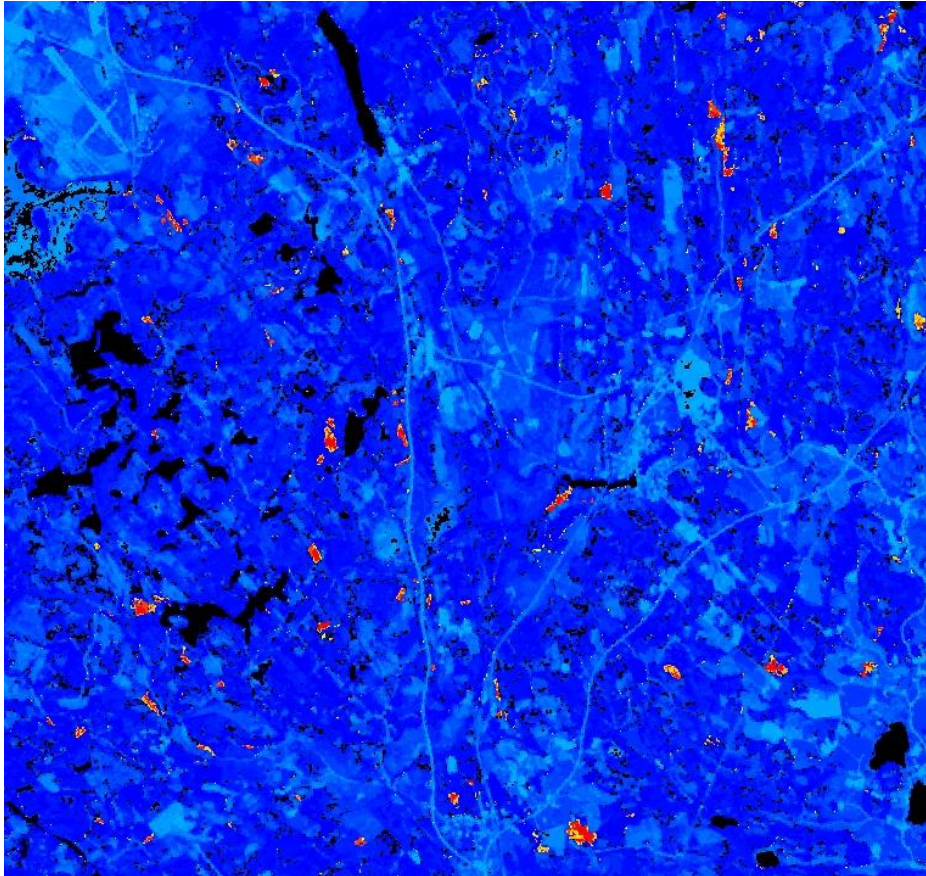
N=108	Keski-pituus (m)	Keskiläpi-mitta (cm)	Runkoluku (/ha)	Keski-tilavuus (m³/ha)	Pohjapinta a-ala (m²/ha)
Ennusteen keskiarvo	17	21	1666	216	23
Bias	-6	-7	1207	-51	21
Bias %	-32	-31	72	-23	90
RMSE	7	9	1424	93	6
RMSE %	41	41	85	43	26

Cuttings in Finland from Landsat-8 2014 & Sentinel-2 2015

Autochange method (VTT). Area size 15 km by 15 km

  6

Map of broadleaved shrubs from Sentinel-2

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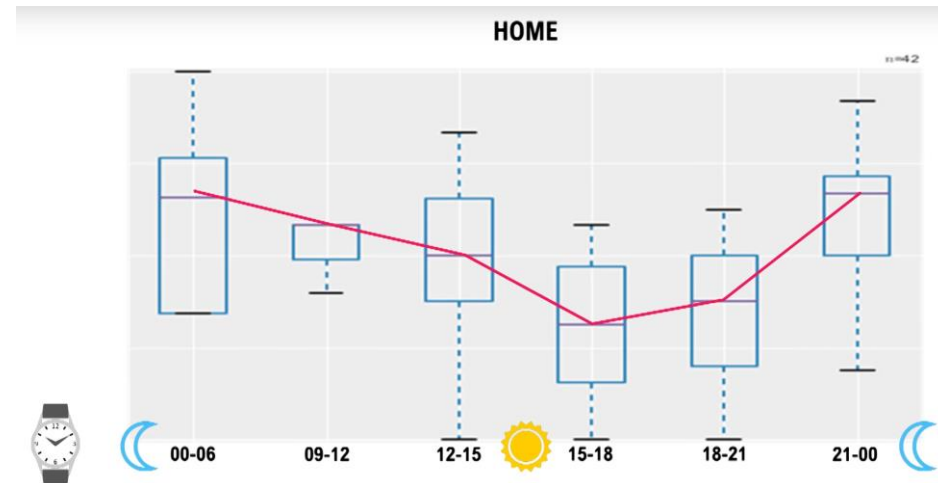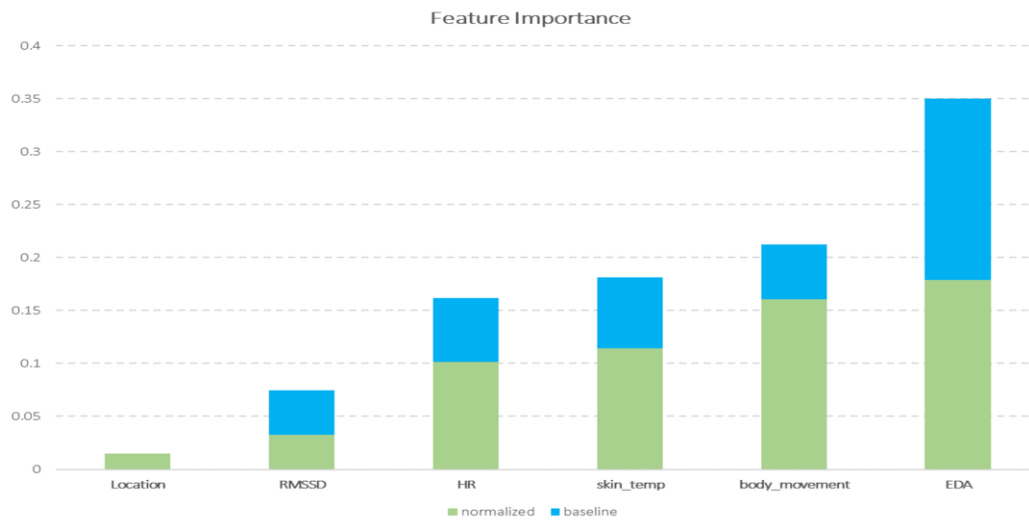*Source: F-TEP and Tuomas Häme, VTT*
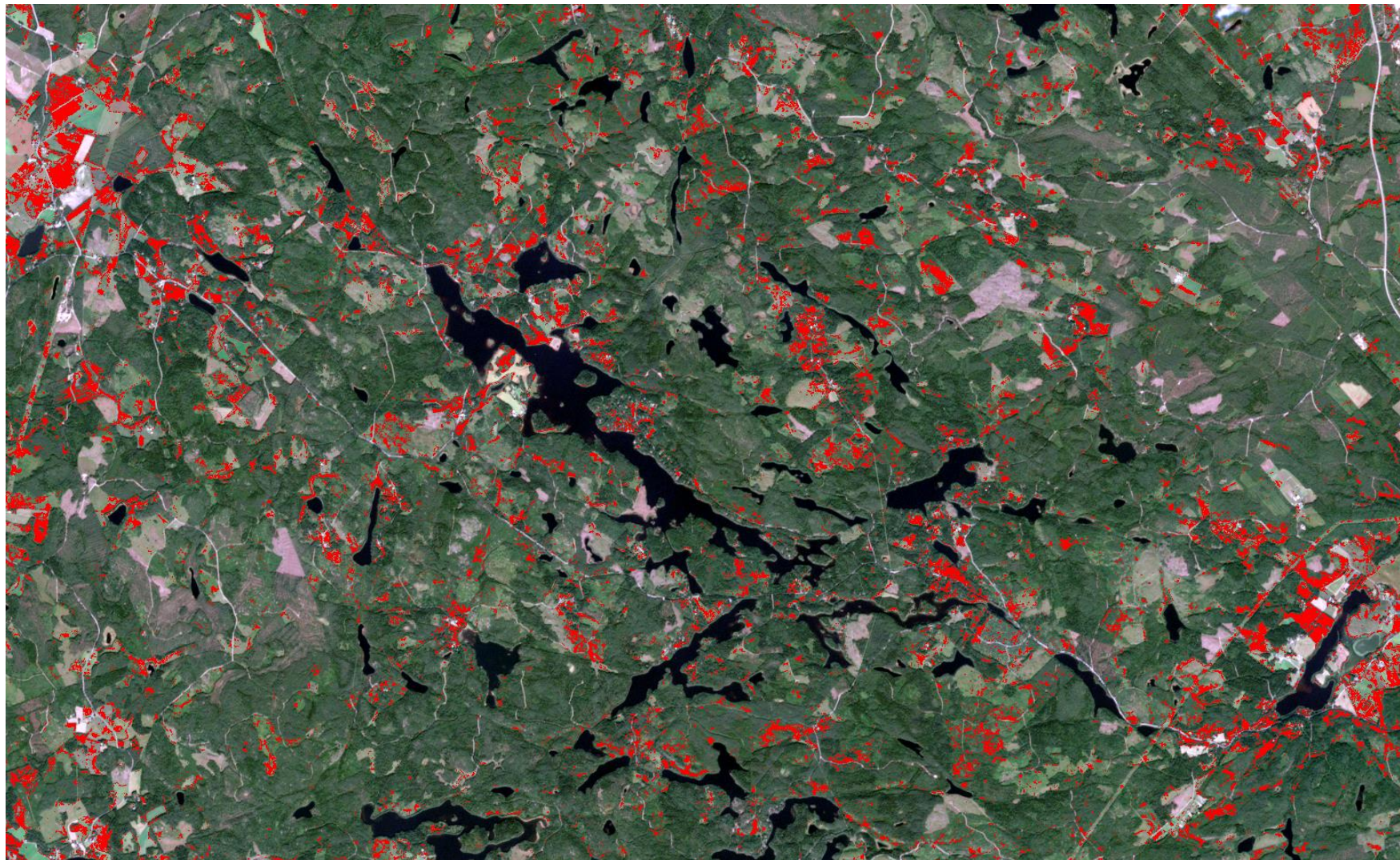
Mental Concentration Sensor

- Need

  - Mental concentration is central in all learning and work

  - Indviduals strive to find optimal conditions – sweet spot –, where their focus is as sharpest

- Our result

  - By gathering biosignals from students and using machine learning, we predicted concentration with **75 %** confidence

Source: Södergård, C, Hälvä, H., Measuring Study Concentration with Wearables and Mobile Phones. Submitted to IEEE Pervasive Computing, 2017.

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Online Quality Monitoring Tool - Case SSAB

Over 100 000 measurement points/ industrial site

Measurements made 24/7

Monitored parameters thousands per process point

Source: Heli Helaakoski, VTT

Case SSAB - Quality monitoring for liquid steel making process
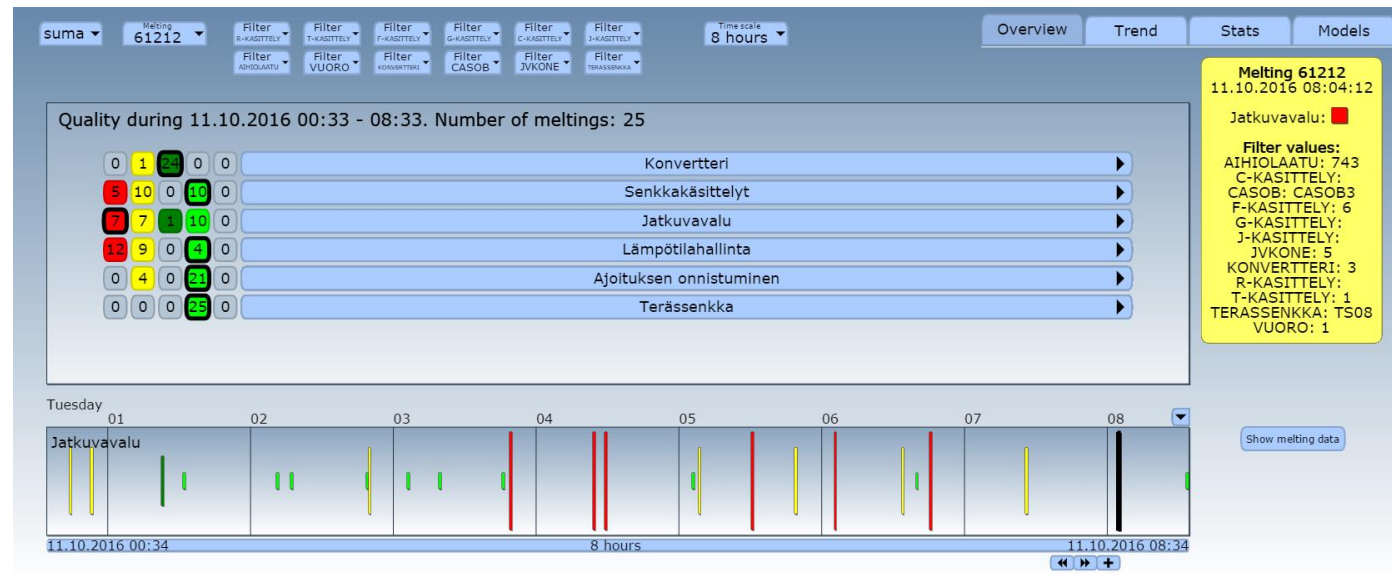
Benefits

- Detection of process deviation from normal state
- Quick analysis how a melting succeeded
- Give overall understanding of whole liquid steel making quality
- Tool to improve steel cleanness for strengthened customer demands e.g. automotive industry
- Help and support product development and operators in processing quality deviations
- Fasten development work
- Monitoring tool can be used as learning tool

Contact
Heli Helaakoski, VTT
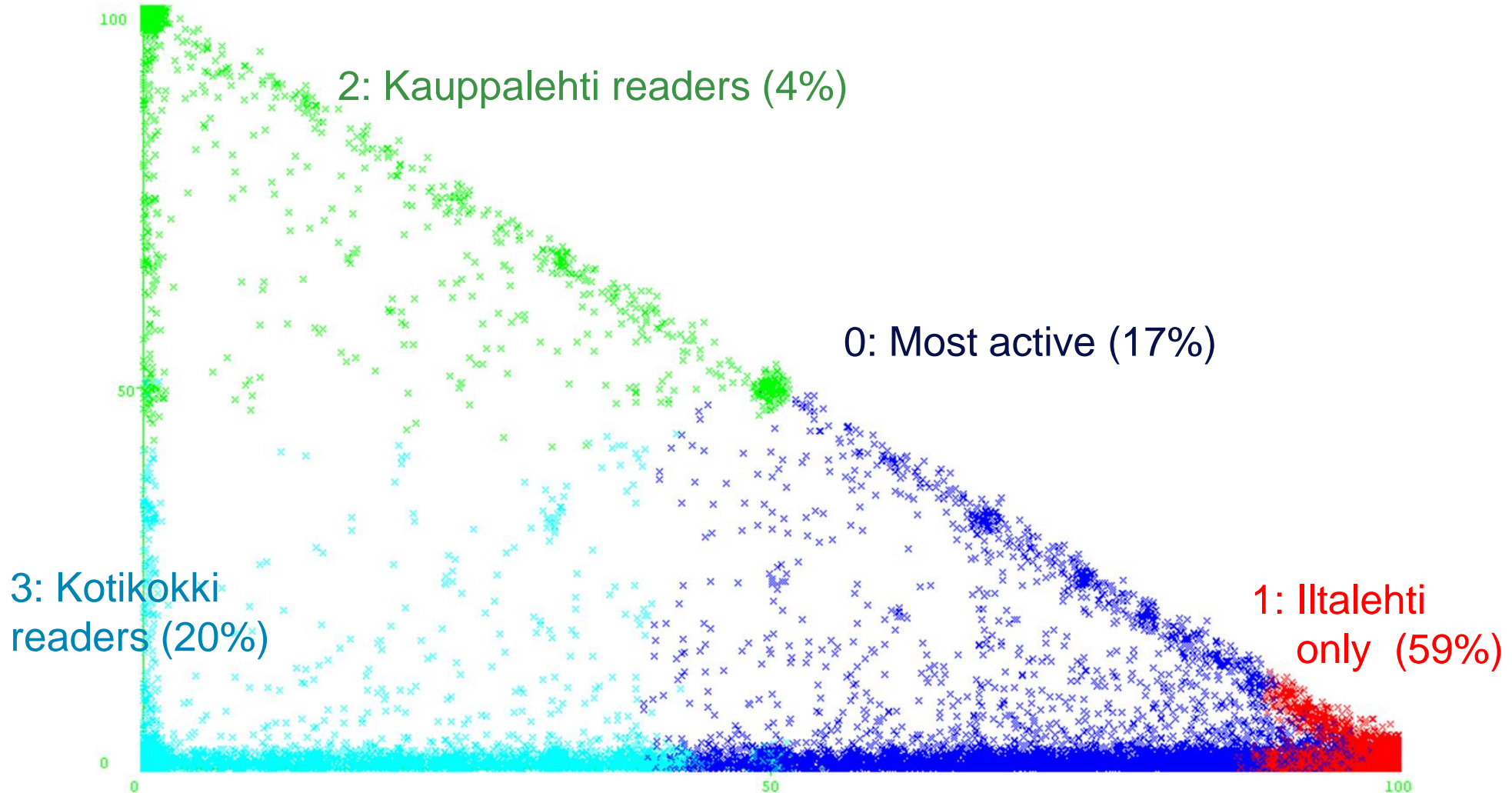Agne Bogdanoff, SSAB

Customer data analysis – case media users

Clustering users based on their reading habits

2: Kauppalehti readers (4%)

0: Most active (17%)

3: Kotikokki readers (20%)

1: Iltalehti only (59%)

Most users read daytime
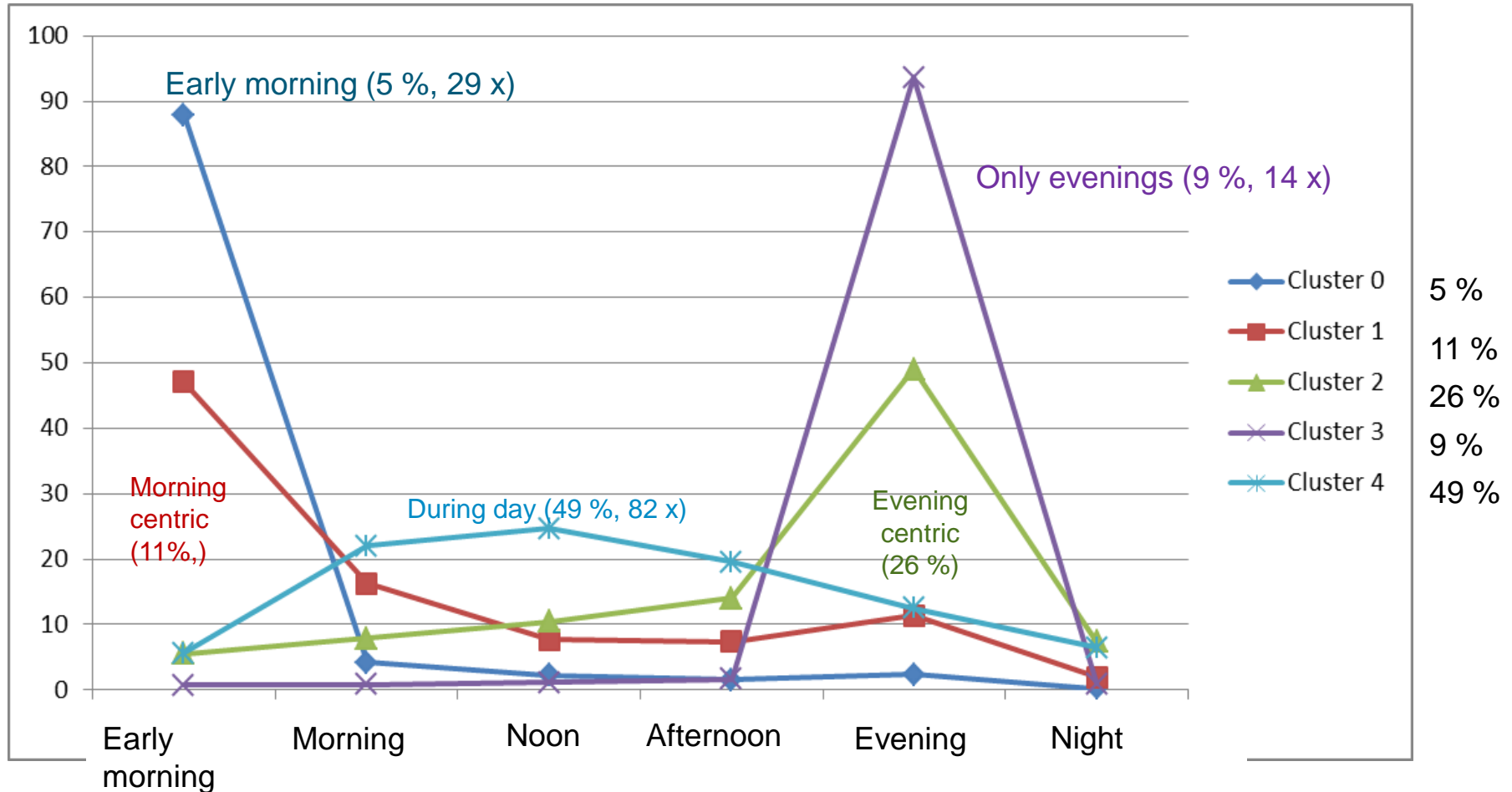
TECHNOLOGY FOR BUSINESS