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UNIVERSITY OF SKÖVDE

SUPPORTED BY Knowledge Foundation

Security Arena - Information Fusion

Skövde – 7 April 2010

Infofusion Research Program, Skövde, Sweden

Sten F Andler, Infofusion Program Director

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The Infofusion Research Program

- Funded by the Swedish Knowledge Foundation with support from the University of Skövde and a number of local companies
- $16M over 6 years (April 2005 - March 2011)
- Employs (full-time)
  - 1 professor
  - 2 post-docs
  - 10 PhD students

  \+ otherwise funded PhD advisors and PhD students

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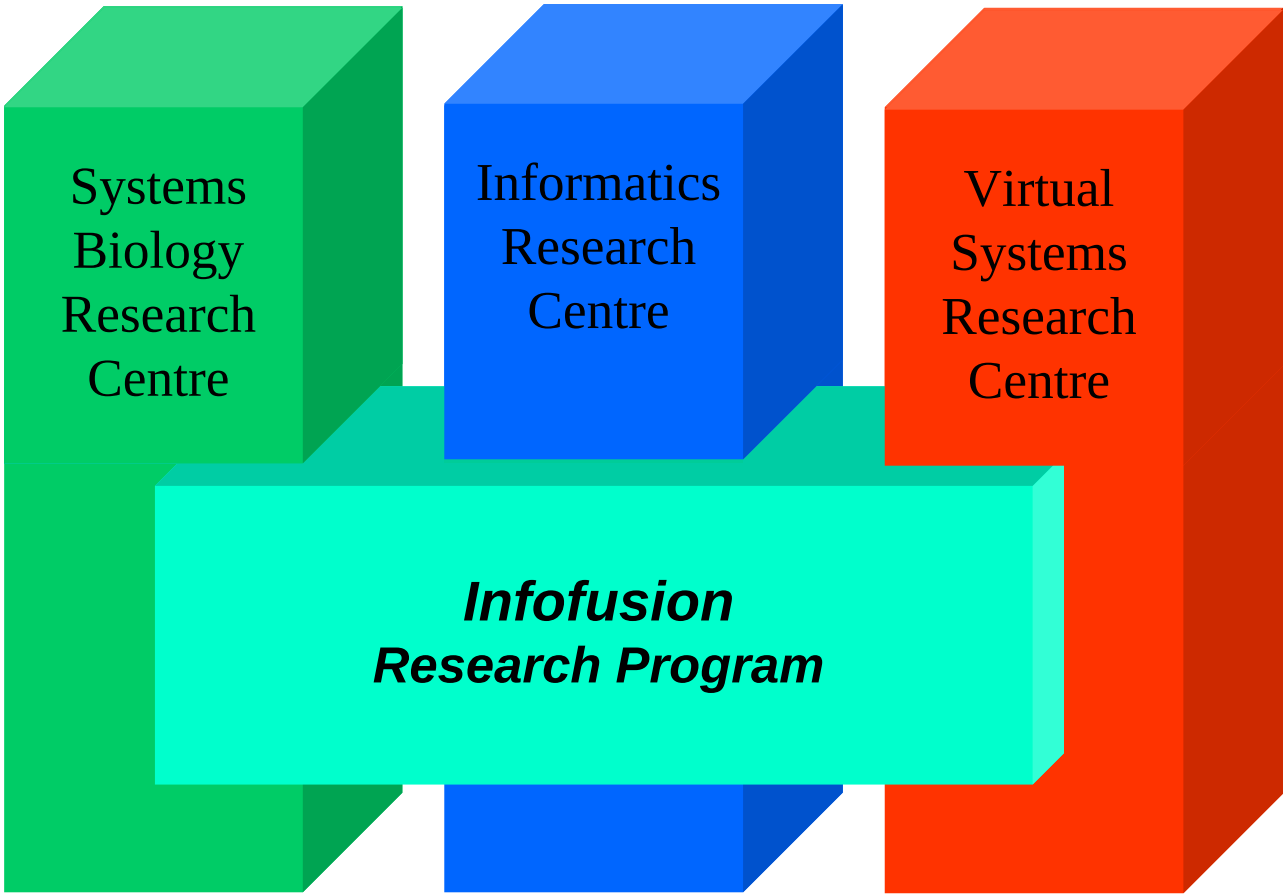
Infofusion and Research Centers



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Outline

- What is Infofusion?
- Vision
- Strategic areas
- Challenges

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Our definition of Information Fusion

"Information fusion is the study of *efficient methods* for automatically or semi-automatically *transforming information* from different sources and different points in time into a representation that provides *effective support* for human or automated decision making."

– Boström, Andler, Brohede, Johansson, Karlsson, van Laere, Niklasson, Nilsson, Persson and Ziemke (2007)

c.f. - Journal of Information Fusion,
- Journal of Advances in Information Fusion,
- International Conference on Information Fusion, etc,

Advantages of information fusion

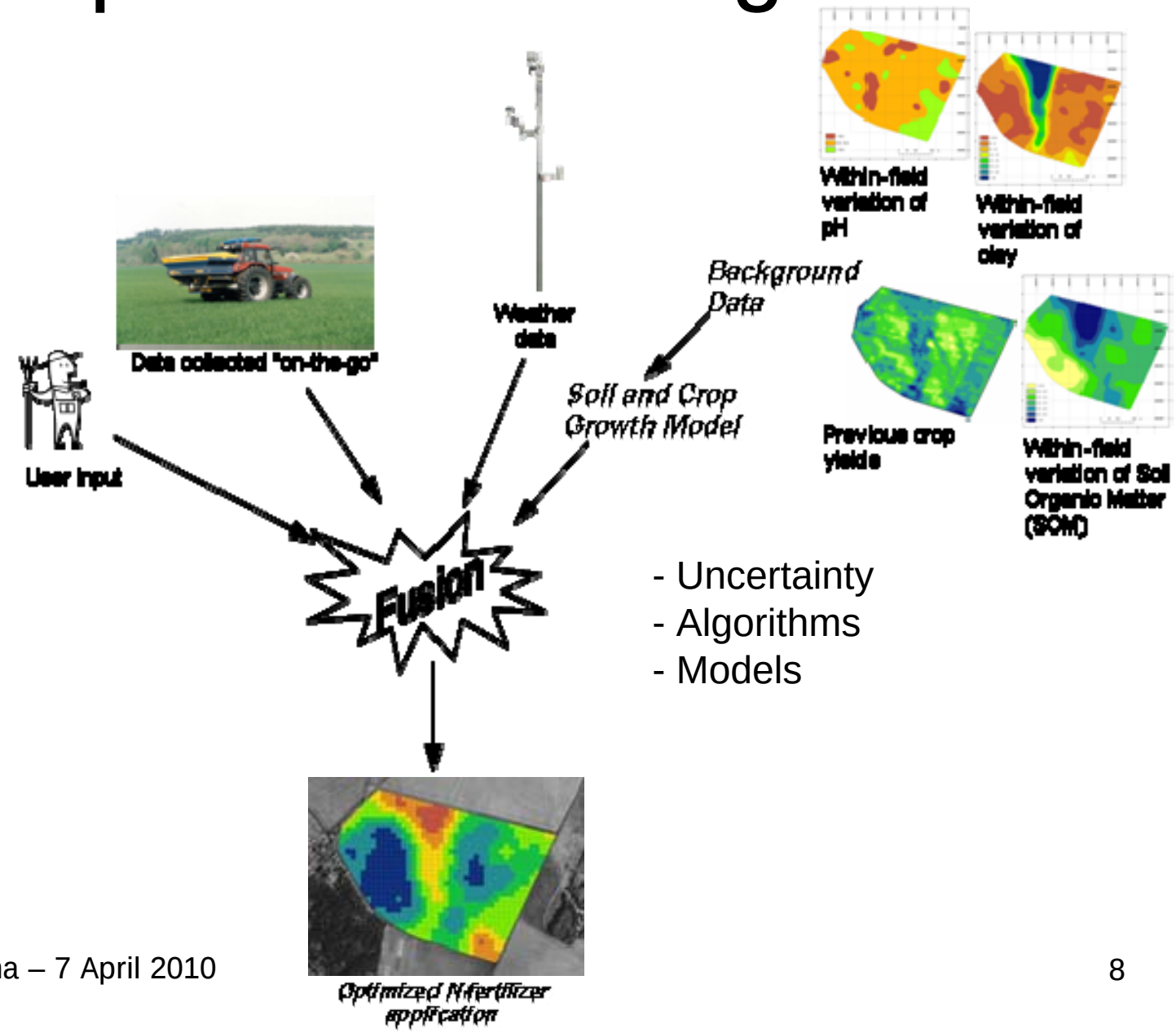
- Accuracy
  - multiple fragments (pieces of information) are used to reduce uncertainty in estimates
- Dimensionality
  - multiple fragments are used to derive new (not directly unobservable) information
- Robustness
  - sensitivity to erroneous data is reduced
- Effectiveness
  - allows handling massive information
  - Manual or (semi-)automatic reasoning and action

Broad interest in IF

Interest for information fusion has arisen in many different application fields:

- Defense (establishing commander's decision support)
- Robotics (enable robot autonomy)
- Computer vision (multiple camera for depth)
- Biometrics (combining fingerprint, gait, voice, iris, ...)
- Data mining (data cleansing - decreasing errors in data)
- Machine learning (combining outputs from learned classifiers)
- ...

Example: Precision agriculture



- Uncertainty
- Algorithms
- Models

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Vision

- Maintain a Center of Excellence in High-Level Information Fusion
  - With Strategic Partners (industry/research)
  - In the most strategic expansion areas
    - Where IF is critical to success of system
    - With major impact on civilian applications of IF
  - With Research Centers and Gothia

Strategic areas in High-level Information Fusion

- Civil security
  - Crisis management
  - Terrorist scenario, harbor security
- Automotive and transport systems
  - Manufacturing decision support systems
  - Efficient transport, dangerous goods
- Health care, energy, environment
  - Elder care, health care monitoring
  - Energy efficiency awareness

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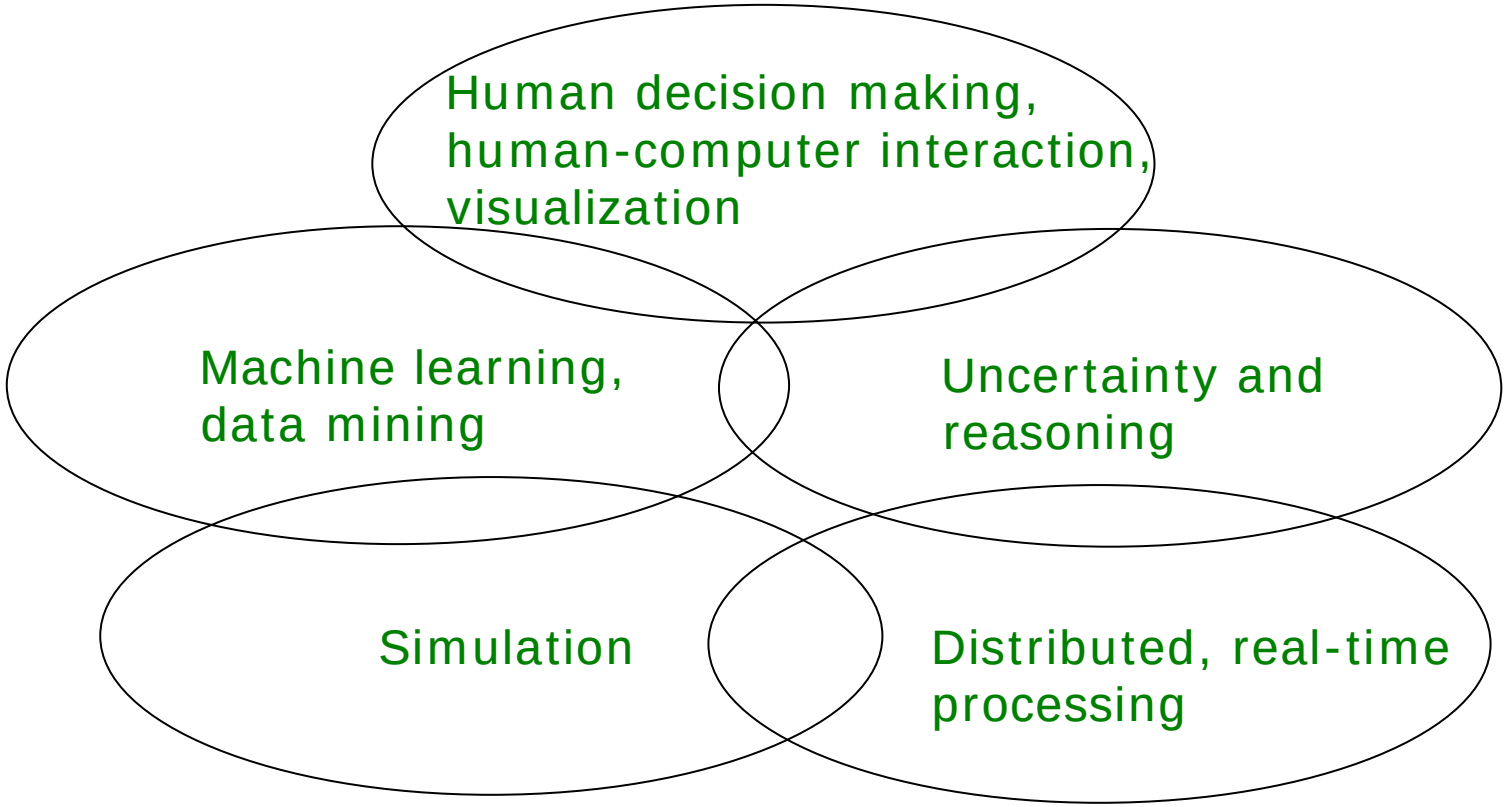
Research areas



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New IF application projects

- NFFP5: National aeronautics research program
  - 2 PhD student projects from 2010 - with SAAB Aerosystems
  - future decision support for the JAS Gripen airplane pilot
- Transport: Holistic simulation-based optimization
  - project discussions
- WeShare2012: EU regional funding
  - building a demonstrator for health-care monitoring applications
- Envolve: Energy involvement and engagement
  - Information Fusion for Energy Efficiency
  - analysis of network and customer electricity usage
  - strategic university funding

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Envolve – Energy Efficiency

- Strategic problem for society
  - EU climate goal: 20-20 by 2020
- New application domain for IF
  - Apply Situation awareness, Anomalies, etc
- External Partners
  - Power network owners, power/utility suppliers
  - Power meter equipment and data collection
- Funding opportunities

Gunnar Mathiason & GSP projektarena

Research Challenges

- Energy consumption patterns
  - Electricity consumption patterns
  - State of local electricity network
  - Local of usage reported daily/hourly
- Smart Grid requirements
  - Local power production (wind, solar, water)
    - Smaller scale distribution, many directions in grid
    - Automatic broker for proper balance
  - Meter replacement made (SEK 15 billion)

Project Themes

Envolve

Energy involvement and engagement

Enlight

End user awareness of own energy efficiency

Engage

Involve next generation energy users

AMMend

Awareness o the status o the electricity grid

Aware

Situation awareness for societal functions

New focus: Software Systems Prototyping & Evaluation

- Develop prototype systems
  - E.g. simulate, partially simulate
- Evaluate systems in meaningful ways
  - E.g. ROI
- Employ domain knowledge
  - E.g to evaluate effect of decentralization for improving availability/decision making
- Study effect of decentralization
  - Rather than throughput, etc.
  - Expertise in dependability, databases
- Experiment: Evaluate effects of eventual consistency

Jonas Mellin & Masters student