Weak Signals

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Anwendungen 1 Präsentation

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What are Weak Signals?

- *"Weak Signals are* **first symptoms** *of strategic discontinuities, i.e.* **symptoms of possible change** *in the future, acting as warning signs of new possibilities"* [FoS13, Seite 8, nach Holopainen et al]

- *"Warnings (external or internal), events and developments which are still* **too incomplete to permit an accurate estimation** *of their impact and/or to determine their full-fledged responses"* [FoS13, Seite 9, nach Ansoff].

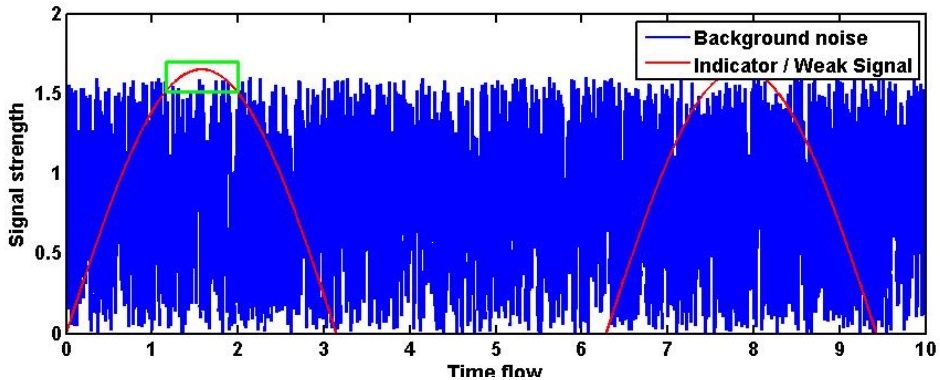

Abbildung : Illustration of a Weak Signal

Properties of weak signals

- Weak signals can be overseen
- **Hidden and extracted** from giant amounts of other data $\rightarrow$ **Big Data**
- They are are just clues, not proofs
- Serve only as a **possible prediction** what will happen
- May develop into strong signals or even a (mega)trend

- $\Longrightarrow$ Trying to **predict the future** by using weak signals

Use Cases

- Disaster control [QER10, Page 5] → (strategic) early warning
- Fighting organized criminality [CIS08] → indicator and warning analysis
- Detecting economic developments [Swi13] → issue management / risk management
- Prediction of trends in general [iKn] → future studies

Idea/Methodolgy

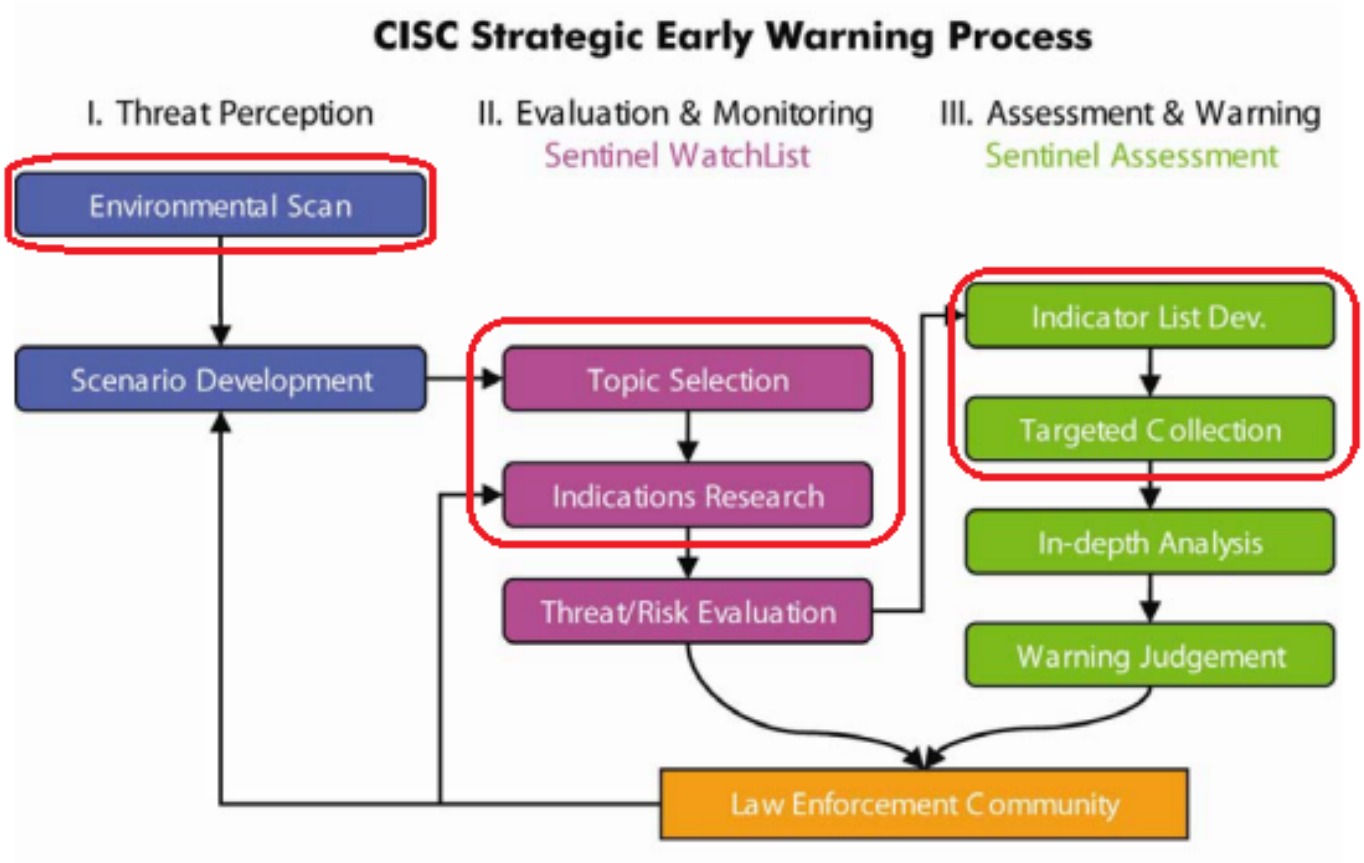

Abbildung : CISC Methodology mit hervorgehobenen Informatikansätzen [CIS08, Figure 6, mit Hervorhebungen]

Environment

- BigData (as lot of "background noise")
  - How to store large amounts of data?
  - Data retrieval?
- Artificial Intelligence
  - What are we searching for?
  - How to extract data?
- Domain Knowledge
  - What kind of knowledge do we need?
  - Who to ask?
  - What can be indicators of change?
- Sociology
  - Tunnel vision - we only see what we expect to see.
  - How to convey persons of whatever we may find?

One possible position in ACM CCS

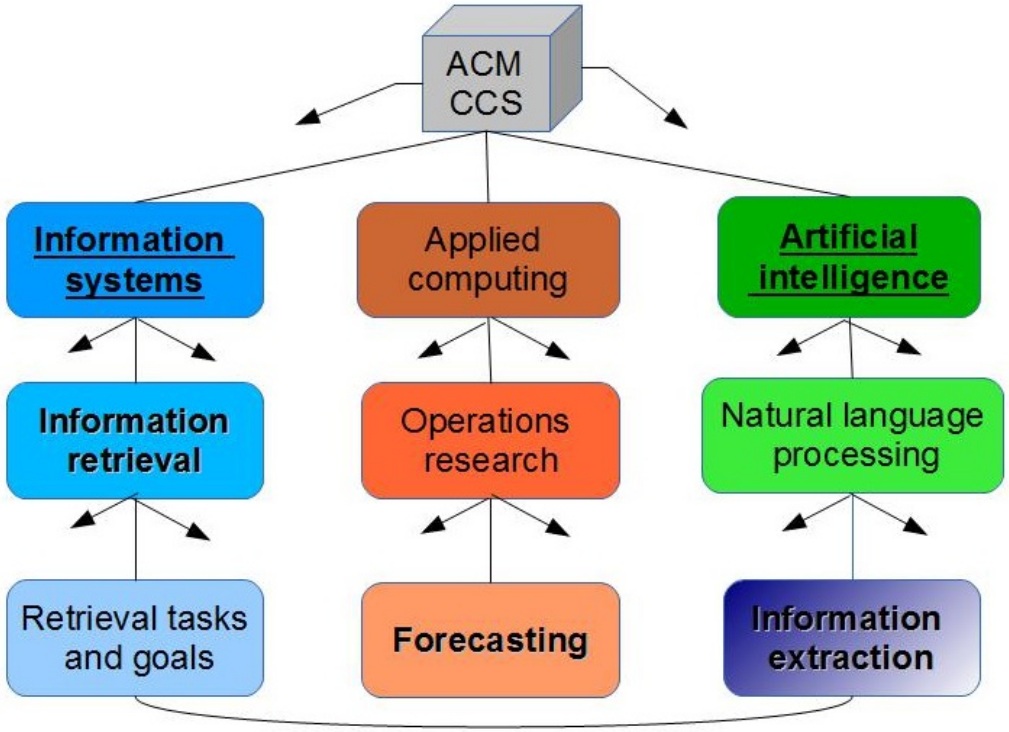

Abbildung : Illustrierte Position im ACM Computing Classification System [ACM12, basiered auf Quelle]

- May slide within the classification
  $\Longrightarrow$ depending on the technical focus and topic

How can computer science help

- Data storage
  - Database technologies
  - (Distributed) processing
- Data Extraction
  - Text Mining
  - Social Media Analysis
- Data Analysis
  - Indicator research
  - Building a model for a domain and its dynamics

  $\rightarrow$ Help to understand a domain

  $\Longrightarrow$ Mainstreaming knowledge
- Visualisation of results

Text Mining: Basics

- Simplest idea: **Bags of words** without semantic ($\rightarrow$ document term statistics)[TEL11, see P. 22ff]
- Preprocessing
  - Remove stop words
  - Tokenize to n–grams
  - Part of speech tagging
  - Stemming
  - Determine document term statistics

Text Mining: Weak signals

- Probabilistic Topic Models $\rightarrow$ Try to determine topic on term frequencies
- Raising and falling terms $\rightarrow$ **Compare** bag of words **to a baseline**
- Novel topics $\rightarrow$ Same idea but involing probabilistic topics models
- Boundary Crossing: Find **already emerged trends** (and their indicators) in a different domain and **transfer** them to your domain
  - Same domain: Economical trends in the U.S. $\rightarrow$ Europe
  - Different domains: Smartphone apps are important $\rightarrow$ Is the app concept of relevance for smart TVs?

Network analysis approaches

- (Social) Networks containing information
  - Who is linked to whom?
  - What is liked by a person?
  - Maybe even location, ...
- Building influence networks [Pul11, see]
- Can we **forecast** trends by analysing these **(hidden) influences**?

Persons and organizations

- Harry Igor Ansoff ($\star$1918 in Wladiwostok †2002 in San Diego)
  - Mathematician and economist
  - Theory of "graduated response through amplification and response to **weak signals**"
    $\Longrightarrow$ 5 step system from idea of change upto calculating the costs [Wah13, nach Ansoff (1975)]
- Organizations
  - Intelligence services
    Criminal Intelligence Service Canada (CISC) $\rightarrow$ Early warning methodology [CIS08]
  - European Commission $\rightarrow$ Report on Weak Signals Collection [TEL11]

Meetings

European Conference on Technology Enhanced Learning ([EC:, related to TEL Map [1]]

→ 8th European Conference on Technology Enhanced Learning in Paphos (Cyprus) — 17 - 21 September 2013

Conference on Knowledge Discovery and Data Mining (ACM KDD [ACMa])

→ 20th ACM SIGKDD Conference in New York — 10 - 13 August 2014

The International Conference of the System Dynamics Society [2] [SDS]

(linked to ACM SIGSIM [3])
→ 32nd International Conference in Delft (Netherlands) — 20 – 24 July 2014

- Conferences / Paper on specific topics, related to early warning
- Irregular workshops etc. [FoS13, e.g.]

[1] TEL Map is funded by the EU and aims e.g. scan for relevant emerging trends [TEL]

[2] System Dynamics aims to e.g. model and analysis complex dynamic systems

[3] ACM Special Interest Group: SImulation and Modeling [ACMb]

Anwendungen 1 / 2

- Expand knowledge
- Find information sources on concrete topic
- Further search for papers and frameworks
- $\Longrightarrow$ read, read, read and fun, fun, fun

Projekt 1: Weak signals in politics

- Politics concerns all of us
- Politicians talk a lot, but they are not saying anything at all (at least sometimes)
- Speeches are given to protocol - instead of adressing the audience
- Opinions are raised in comitees $\rightarrow$ Maybe existing protocols
- Media may not publish all they know

$\rightarrow$ Influence networks and opinion making are sophisticated

$\Longrightarrow$ Is it possible to **find and inform about emerging polical trends** before they get obvious?

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Questions?