

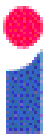


# The Nature of Informatics

Alan Bundy

School of  
**informatics**

University of Edinburgh



# What is Informatics?

*The study of the structure, behaviour, and interactions of both natural and artificial computational systems.*

## What are the Big Informatics Questions?

- What is the nature of computation/information?
- What is mind?
- How can we build useful ICT products?

# Subfields of Informatics

- **Computer Science:** studies and builds artificial systems.
- **Artificial Intelligence:** emulates intelligence within artificial systems.
- **Cognitive Science:** studies natural systems from a computational viewpoint.

# Analogy with Maths and Physics

Scientific Informatics	Pure Mathematics
Basic AI	Applied Mathematics or `Pure` Engineering
Applied Informatics	Engineering
Cognitive Science	Theoretical Physics
Psychology	Physics

# Old Boundaries are Breaking Down

- Many AI techniques are now mainstream CS,
  - e.g. renewed interest in stochastic and search methods.
- Natural systems inspire new artificial techniques,
  - e.g. brain architecture as model for computer architecture.
- Common, cross-cutting themes,
  - e.g. logical reasoning, probabilistic reasoning.
- Need for new unifying science: Informatics.

# Science vs Engineering in Informatics

- **Informatics as Science:** theory and experiment
  - deepen understanding of tasks and techniques;
  - suggests new techniques;
  - cognitive modelling improves understanding of natural systems.
- **Informatics as Engineering:** new techniques
  - suggest new applications;
  - better understanding leads to greater dependability;
  - results feed back into science.

# Exploration of Technique Space

- Informatics as the space of computational techniques.
- Job of Informatics to explore this space.
  - Which techniques are good for which tasks?
  - What are properties of these techniques?
  - What are relationships between these techniques?

# What are Informatics Techniques?

- **Information Representation:** e.g. databases, hash tables, production rules, neural nets.
- **Algorithms:** e.g. quick sort, depth-first search, parser.
- **Architectures:** e.g. von Neumann, parallel, agents.
- **Software Engineering Processes:** e.g. extreme programming, knowledge acquisition/requirements capture.
- **Theories:** e.g. denotational semantics, process algebras, computational logics, hidden Markov models.



# Exercise: Informatics Techniques

*What additional Informatics techniques can you think of?*

- Information Representation?
- Algorithms?
- Architectures?
- Software Engineering Processes?
- Theories?
- Other kind?

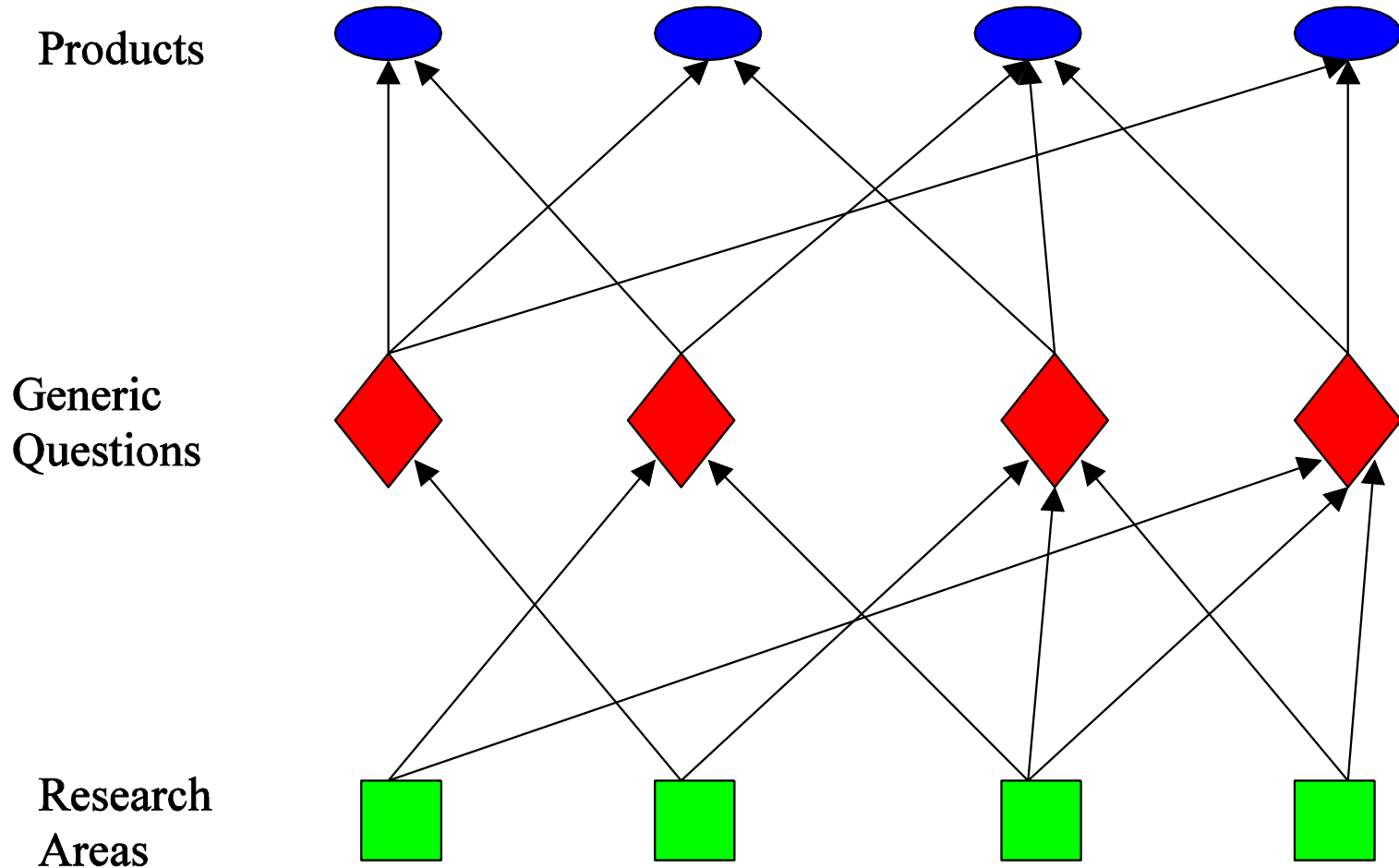
# The Space of Informatics Techniques

- Multi-dimensional space of techniques,
  - linked by relationships.
- Rival techniques for same task,
  - with tradeoffs of properties.
- Complementary techniques which interact.
- Build systems from/with collections of techniques

# Generic Questions

- General, long-term questions addressed by Informatics researchers:
  - How can computer systems be made easier to use?;
  - How can computer systems be made more dependable?
  - How can we build computational models of complex systems?
- Many different research areas contribute solutions.
  - Ease of use: HCI, programming languages, graphics, ...
- Multiple solutions required for ICT products.
  - Usability, dependability, efficiency, ...

# Technology Transfer in ICT



# Research Platforms

- Virtual machines on/with which further research is built, e.g.
  - programming languages, analysis/development tools, operating systems, reasoning engines, parsers, ....
- Improve productivity so facilitate new possibilities.
- May incorporate new techniques.
- Criteria: dependability, efficiency, support/maintenance, usability.

# Computational Thinking

- Computational thinking influences many other disciplines.
- The ways in which they formulate hypotheses, e.g.,
  - DNA as a program, the universe as a computer.
- The kinds of questions they ask and answers they accept,
  - e.g., e-Science, morphing faces.

# Summary

- Unified computational study of natural and artificial systems.
- Exploration of techniques space.
- Both science and engineering.
- Recommended reading: “What is Informatics?”
  - <http://www.informatics.ed.ac.uk/about/vision.html>.