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Limits of Information-technological Models

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Limits of Information-technological Models

Organizers: Wolfgang Coy, Jörg-Martin Pflüger, Bernhelm Booß

Introduction

Computer programs model technical and social reality by formal means. These models construct a new reality. It is a fundamental necessity that this modelled reality is specified in strict details. Everything has to be stepwise transformed into smaller modules or "objects". The relations between these modules has to be defined explicitly, even if detailed scientific data, experience or insight are not available or unreliable. This modular approach of computer science defines reality in a restricted manner, evoking specific questions like:

- How does our understanding of reality change when every intension must be specified extensively?
- Is simplicity a sufficient measure of (otherwise correct) theoretical insight?
- Which cognitive insights are lost when experiences are reduced to programmed models?
- Is there some "magic realism" behind the rational, but necessarily limited models of nature and how strict or limiting is the role of scientific thought as a basic ideology of the industrial societies?
- How may philosophical relativism be used as a theory of science?
- How is computational exactness related to some presumably feasible but not well-understood ad hoc-models?
- In which way do different software development approaches relate to different world views?
- Will cooperative user participation improve the benefits of computer applications? Is there room for conflict in a basically consensus-oriented process of modeling ?
- What are driving forces behind the simplification of reality (realities?) to technologically fixed social relations.

2. Final Programme

Monday, February, 10th 1992

9.00	Bernhelm Booss	Some reminiscences from Mathematics and Peirce's Philosophy
10.00	Jeff Paris	Modelling the Expert
11.00	Peter Harremoës	Inference in Bayesian Networks and Causal Expert Systems
12.15		Lunch, naps, sports or small working groups initiated by the participants
15.30	Peter Schefe	Modelling of Reasoning with Vague Concepts by Fuzzy Logic
16.30	Otthein Herzog	LILOG – Wissensrepräsentation und Programmierung
18.00		Dinner, then Informal get-together

Tuesday, February, 11th 1992

9.00	Heinrich Rust	Why we need Error-Free Programs and why we will not get them
10.00	Johann Markowsky	Insurability of Software Related Risks
11.00	Andreas Pfitzmann	Limits of Modelling Caused by Limits in IT-Security
12.15		Lunch, naps, sports or small working groups initiated by the participants
15.30	Peter Naur	The Metaphysics of Constructed Models
17.30	Wolfgang Krohn	Was heißt "Common Sense" ?
18.00		Dinner
19.30	Michael E. Abbott	Informal Methods and Magic Realism: The Limits of Modelling and the Limits of Angelology – A Primarily Theological Perspective

Wednesday, February, 12th 1992

9.00	Jos E.C.M. Aarts	Medical Informatics and the Limits of Modelling
10.00	Edeltraut Egger	Limits of Modelling Time Management (Case Study: Surgical Clinic)
11.00	W. Glen Pate	Modelling the Sick and the Aged: Computers in Nursing
12.15		Lunch
13.15		Walk (or Visit to Trier by Bus)
18.00		Dinner

Thursday, February, 13th 1992

9.00	Wolfgang Hoeppner	When Crucial Prerequisites Look Illusory: The case of User Modelling for Natural Language Systems
10.00	Reinhard Keil-Slawik	Supporting Communication & Understanding Through the Use of Formal Artifacts
11.00	Kevin Kelly	Convergent Relativism
12.15		Lunch, naps, sports or small working groups initiated by the participants
15.30	Lothar Budach	The Provably Intractable
16.30	Günther Hotz	Über Einfachheit
18.00		Dinner
19.30	Discussion	"Eine einheitliche Grenze der Modellierung - oder viele Grenzen?" Initial Statements by Wolfgang Krohn, Karl-Heinz Rödiger, Jörg-Martin Pflüger and Wolfgang Coy

Friday, February, 14th 1992

9.00	Jochen Ludewig	Models and Software Metrics
10.00	Britta Schinzel	Methodische Probleme der KI
11.00	Phil Davis	The Mathematization of Graphic Art: Birth, Death, and Resurrection
12.15		Lunch
13.00		Final Discussion of the Conference

3. Abstracts of Presentations

Medical Informatics and the Limits of Modeling

Jos Aarts, Nijmegen, The Netherlands

In my presentation I have considered intuitively what limits are exististing from a pracmatic point of view.
First I tried to define what medical informatics is about. I followed the definition of E.H. Shortliffe [1] who states that medical informatics deals with the study of medical data, knowledge and information, including their proper use for health care, biomedical research and decision making. So medicine is the object of study. The epitomy of medicine is professional judgement and deriving from that diagnostic reasoning. Little is known about the reasoning process of physicians and studies show that there exists quite a disagreement among physicians about the interpretation of medical data [2]. Knowledge based systems deriving from medical experts thus show a fair degree of uncertainity of correctness. Only KB systems that derive knowledge from the literature or comparable sources and/or dealing with narrow defined fields do well. Maybe this disagreement is a pragmatic limit of medical informatics.
I stated the importance to focus on the development of an accepted taxonomy of medical and nursing data and knowledge and focussed on the importance of well structured patient record. Thus can a better base be forced for the development of computer applications in health care. Medical informatics will increase in importance because of the pressure of society to increase the efficacy and efficiency of health care delivery. This presentation took shape during the discussion of the Seminar. For my work in biomedical modelling I refer to [3].

[1] E.H. Shortliffe. Medical informatics and medical decision making. Decision Making 1991, 11 (suppl): 2-14.

[2] A.M. van Günneken, J. van der Lei. Understanding differential diagnostic agreement in pathology. In: P. Clayton (ed.) Proc. 15th Symp. Comp. Appl. med. Care. New York: McGraw-Hill, 1991, 99-103.

[3] J.E.C.M. Aarts. D.P.F. Möller., R.P. van Wijk van Brievingh. Modelling and simulation in biomedicine. In [2] 900-902.

Informal Methods and Magic Realism: the Limits of Modelling and the Limits of Angelology: A Primarily Theological Perpsective.

Michael B. Abbott, THE, Delft, The Netherlands

This lecture about the mythological dimension of modelling was specially prepared for 'Schloß Dagstuhl'.
Every formalism necessitates a division: the formalism introduced over the first half of the XVIIth century necessitates a division between the activities (functions) of the Church and the activities (functions) of science. It thus divided formalism between those of a congruence between religious consciousness and social interest (the 'world of society') and a congruence between mental consciousness and natural interest ('the world of nature'). The space between those, which in earlier holisms had been occupied by alchemy and astrology, now became the place of technology. There occured a corresponding division of faith, between "faith in God", and "faith in science" which often led to conflicts.
This earlier period was characterized (by Foucault, in 'Les mots et les choses') as one of two discontinuous changes in the history of thought. Its study recordingly raises severe historological problems. Foucault showed how it could be investigated in terms of the changes that then occured in the use and functioning of *signs.* The functions of the sign (how the transformation sign → information → knowledge occured) become further divided between *mathesis* and *taxinomia.*
The formalizations that were so established were subverted, starting in the XIXth century, by their own devices (e.g. Dedekind, Cantor, Skolem, Gödel, Church, Turing, on the *mathesis* side). They are subverted further by modelling. We regard a model of any collection of signs that itself serves as a sign. We observe that the sign for which the model server communicates a truth to us (an intuitive truth, an experimental truth), even though the way in which the system of signs produces this truth is not deducible.
We then speak of a 'magic realism'. Examples were shown from Computer Fluid Dynamics (CFD) (Abbott and Basco, 1989, CFD, Longman and Wiles, Abbott, 1991, Hydroinformatics, Avebury Technical). For example: "(Numerical) instability is the numbers' way of telling us that our code contains contradictory statements."
This is not a scientific truth, but a very basic technological truth (and even, possibly, a kind of 'wisdom'). It corresponds to the (non-trivial!) paradox that:
"The model is telling us things of which we were not at all aware even though the model is entirely a product of our own minds."
We can show many such representations of a *number myth,* to the truth of which we are pursuaded by experience, so that its adoption appears as an 'set of faith'. It follows that, when modelling, we all have to listen carefully to what the model has to say: the limits of the programmable machine in this di-

mension are much less restricted by our ability to express oneselves and much more by our ability to listen.
The relation to post modernism was explained, critically. Insofar as it could be said (Novalis) that romanticism *was* translation, we can say that post modernism *is* quotation. Post-modernism thereby is to 'move out of time', and thereby, draws upon the relation between Time and Being *(Sein und Zeit)*, so as to take Being 'out of time', and so into the realm of *Mythos.*
This development was related to the conflict between subsymbolic paradigms (connectionism, with its own magics) and synergetic paradigms (which tend to block the operation of the myth). Through magic realism the machine becomes a *messenger*, i.e. the equivalent of the angel.
Consideration was then given to how we might talk about this phenomenon: to what kind of truth are we listening and to what kind of logic are we thereby impelled? We are thereby led to consider the truths and logics of dogmatic science, 'the science of listening to the word of God.' We are led to consider Barth's description of the 'necessary brokenness' of all theological thought and utterence. Considering the limits of angelology (Barth, K., 1960, Church Dynamics, III,3) suggests that magic realism marks out the limits of the potential of the sign within the ambit of the programmable machine.

Some Reminiscences from Mathematics and Peirce's Philosophy

Bernhelm Booss-Bavnbek, Roskilde, Denmark

I. The "limits" we want to discuss are not limits that we want to reach or surpass but rather the 'off-limits' that our practical and professional ethics should respect. Therefore, let us try to talk this one week not of promises, prospects, ambitions, and aspirations but solely of the present state of our art, where we are now, what we have reached, what we have brought about, and what we have seen with our own eyes.

II. What can be said on the basis of common sense and where is our professional knowledge needed? Which damages can be avoided by insisting on professional quality and which damages are induced by unrestraind dazzling modelling? How shall we redefine the role of computing professionals in society so that the credibility and reliability of modelling are enhanced instead of undermined?

III. We hold that the combination of mathematicians and computer professionals is ideal for that meta-discussion because of our central place in the scientific-technological innovation and because we constitute – together – a field with the oldest professional traditions and the last fixed structures.

IV. A thorough examination of wreckages, 'magic realism', and computer supported blindness in mathematical physics and engineering (in computational fluid dynamics, simulation of material properties, control close to energy optima etc. teaches. (A) Trust your common sense, not computer hidden modelling! (B) Your common sense is not sufficient!
(C) More space for confidence by building science!

The provably intractable

Lothar Budach, FhG, ISST, Berlin

At all stages in the history of mathematics and computer science there have been problems which proved to be intractable using the algorithmic means known by the specialists of that time.
Presenting a series of examples – irrationality of $\sqrt{2}$, solution of algebraic equations by radicals, the Shannon problem for automata in mazes, representation of the Euclidian space by a finite but continuous image in the computer, classification of entities by means of attributes – evidence is given that finding a proof for the intractability of the problem led to new, very often unexpected, and exiting relations to deep mathematical theories and even to the genesis of new theorems: arithmetics of the natural numbers, automorphism groups of algebraic fields *(Galois theory)*, homology groups and covering spaces of labyrinths, homotopy groups and homotopical equivalence of topological spaces, desorder of finite simplicial complexes.
It appears pretty sure that the unsolvability of interesting problems, e.g. the complexity of boolean functions, the problems *L=NL?* or *P=NP?*, is caused by a poor understanding of the underlying mathematical structures which in turn causes a poor understanding of the algorithmic means.

Maschinisierung und dynamische Modellierung von Phänomenen mit informationstechnischen Mitteln

Wolfgang Coy, Bremen
(short statement)

Bei der programmtechnischen Umsetzung wird im Idealfall auf ein mathematisiertes/formalisiertes Modell zurückgegriffen. Diese Modellierung verlangt im Regelfall eine Menge von Eigenschaften wie intersubjektives Verstehen, Überschaubarkeit, Reproduzierbarkeit, logische Monotonie der Beziehungen, Beschreibbarkeit und die Existenz geeigneter Algorithmen. Diese Eigenschaften sind in wesentlichen Anwendungsfällen nicht oder nur teilweise gegeben. Aus diesen offensichtlichen Widersprüchen folgen erhebliche Umsetzungsprobleme.

The Mathematatization of Graphic Art: Birth, Death, and Resurrection.

Philip J. Davis, Brown University, Providence, R.I., U.S.A.

The history of mathematics displays certain mathematizations in which, over the centuries, professional interest and confidence, and hence support, has oscillated. Among these one may cite astrology, hermetic geometry, and the applications of mathematics to the graphic arts (drawing, painting, sculpture). Concentrating first on the graphic arts and narrow to the mathematization of the human figure, this lecture discusses the goals, the artistic intent (Kunstwollen) of these mathematizations from the ancient Egyptians to Michelangelo. After this, there was a definite decay of interest in the program, and the reasons advanced for this decay will be discussed.
In modern times, beginning, say with Seurat, mathematics has reentered art, and in computer times has done so in an explosive way, but with locally different goals. If, therefore, the past is any guide to the future, recently introduced mathematization e.g., in sports or in the social and economic spheres, may experience similar oscillations. It is not absolutely true, as David Berluisia has suggested, "that mathematical descriptions tend to drive out all others".

Limits of Modelling Time Management (Case-Study: Surgical Clinic)

Edeltraud Egger, TU Wien

The investigation of time-planning practices has shown that time-management is a socially complex task. The social and cultural character of time makes it impossible to model time-management with currently existing methods, like data-comparison (e.g. electronic calendar), optimizing methods (from the field of Operations Research) or qualitative methods (e.g. temporal logic).
The case-study has shown that there are multiple realities within an organization concerning the experience of time, evaluating time-lass, coping with temporal constraints and perceiving organizational and individual failure as sources of temporal problems. The organization defines a 'temporal infrastructure' for the temporal behaviour of individuals and groups, granting different degrees of time-autonomy and facilitating or impeding collaborative decision-making on time matters.
Due to these aspects information systems technology should help to improve actor's basis for ongoing negotiation instead of modelling a group decision process.

Inference in Bayesian Networks and Causal Expert Systems

Peter Harrermoës, Roskilde Universitet, Denmark

Bayesian networks have been used in knowledge representation in Expert systems for about 15 years. A Bayesian network is a graphical representation of a large number of statements about conditional independence of sets of variables, and consists of modes corresponding to variables and arrows between modes corresponding to dependencies between variables. The independence relation may be defined as statistical independence or perhaps axiomatically. There are three main problems in the use of Bayesian networks as model of causal expert systems:

1. It can be shown that: A causes $B \Rightarrow A$ ist ascendent to B and corr $(A, B) > 0$. The implication the other way is false! The model may propose some potential causes, but to point out a cause involves problems, which are not correct by the model.
2. The representation of statistical data by Bayesian networks is generally not unique.
3. The structure of the network is very sensitive to the choice of variables. Nothing is known about the last problem. There has been done a lot of work on the second problem, but still much is unknown. The first problem is essensially non-technical.

LILOG – Wissensrepräsentation und Programmierung

Otthein Herzog, IBM, Stuttgart

(Joint work of the LILOG and KBSSM group)

Anhand einiger Beispiele wurde der Leistungsumfang des LILOG-Systems gezeigt:

- syntaktische und semantische Analyse von deutschen Texten der Textsorte "Reiseführer" auf der Basis des LILOG-Hintergrundwissens,
- Aufbau einer sprachunabhängigen Repräsentation von in den Texten enthaltenen Informationen in einer Wissensbasis,
- Beantwortung von Fragen über die vom LILOG-System erschlossenen Informationen.

Die Elemente der Wissensrepräsentationssprache L-LILOG sowie die Struktur der für diese Anwendung geschriebenen Wissensbasis von Hintergrundwissen – als Basis für die semantische Analyse – wurden kurz erläutert. Es wurde auf die Grenzen und Beschränkungen des Systems hingewiesen.
Im zweiten Teil des Vortrag wurde gezeigt, daß die für diese linguistische Anwendung entwickelte Wissensrepräsentation hervorragend geeignet ist, eine Klasse von Anwendungen ohne Realzeitanforderungen und ohne explizite Anforderungen an Kontrollstrukturen direkt zu implementieren. In dieser homogenen Sprachumgebung ist es möglich, die Korrektheit der Implementierung in Bezug auf die Spezifikation automatisch zu beweisen.

When Crucial Prerequisites Look Illusory: The Case of User Modelling for Natural Language Systems

Wolfgang Hoeppner, Universität Duisburg

One of the most basic issues in linguistic pragmatics is 'Conversational Implicature' as introduced by the philosopher Grice in 1975. This phenomenon is used as a motivation for the prominent role of user modeling in both understanding and the production of linguistic utterances.
User modelling within the framework of AI research is introduced via a-priori assumptions, stereotypes, and dynamical approaches.
Based on these results from Linguistics and AI, problems of user modeling are outlined and illustrated in connection with the project KOPW (*Ko*blenzer *P*räsentation von *W*egauskünften). The generation of route descriptions is one example of language production for which user modeling is an indispensable prerequisite. This prerequisite, however, is hardly obtainable in human computer interaction.
The response to these rather demotivating observations is stated as follows: communication between human beings is a useful pattern for human computer interaction. Nevertheless, there are severe obstacles which indicate that natural language communication with computers requires specific solutions. These solutions might contribute to an explicit indication of the role a machine is supposed to play in communication.

Über 'Einfachheit'

Günter Hotz. Saarbrücken

In der Begründung von Erklärungen von Sachverhalten spielt das Konzept der Einfachheit eine wesentliche Rolle. Wir zeigen in dem Beitrag, daß die Korrektheit einer Theorie über einen Weltausschnitt i.a. nur in Verbindung mit

dem Konzept der Einfachheit festgestellt werden kann. Zwischen konkurrierenden Theorien geben wir der einfacheren den Zuschlag.
In der theoretischen Informatik hat man intensiv sehr verschiedene Komplexitätsmaße untersucht. Somit liegt es nahe diesem Begriff daraufhin zu untersuchen, inwieweit er zur Fassung des intuitiv gegebenen Begriffs der Einfachheit geeignet ist. Hierbei wird man vor allem an das Konzept der Kolmogoroff-Komplexität und ihre Verallgemeinerungen denken. Zunächst liegt es nahe, die Verallgemeinerungen in Betracht zu ziehen, die sich durch eine Beschränkung der Maschinenressourcen ergeben. In einem nächsten Schritt wird man die Maschinen verlassen und sich auf Sprachen beziehen.
Es gibt einige Hinweise, daß die allgemeine Kolmogoroff-Komplexität in dem gewünschten Sinne dienlich ist, wenn man einen Bezug zu physikalischen Theorien herstellt. Geht man allerdings von Maschinen zu Sprachen über, dann können einfache Spracherweiterungen zu sehr unterschiedlichen Einschätzungen der Komplexität verschiedener Theorien führen. Dies steht im Gegensatz zu der hinsichtlich asymptotischen Aussagen bestehenden Invarianz der Kolmogoroff-Komplexität hinsichtlich des Wechsels der zugrunde gelegten universellen Maschinen.

Literatur:

[1] Hotz: "Komplexität als Kriterium in der Theoriebildung", Abhandlungen der Mainzer Akademie der Wissenschaften Nr. 1, Stuttgart: Franz Steiner Verlag, 1988

[2] Hotz: "Was ist künstliche Intelligenz?", Abhandlungen der Mainzer Akademie der Wissenschaften Nr. 2, Stuttgart: Franz Steiner Verlag, 1990

[3] Hotz: "Algorithmen, Sprachen und Komplexität", Saarbrücker Universitätsreden, Vol. 32, 1991

Supporting Communication & Understanding Through the Use of Formal Artifacts

Reinhard Keil-Slawik, TU Berlin

Up to now, we have been mainly concerned with the inherent structural properties of formalisms, the use of formalism and in what way they do help us in creating information and communicate our insights. I will argue that if we do so we have to rethink our basic model of human information processing which is – especially in computer science and cognitive psychology – often merely a variation of technical data processing models. This rethinking can best be paraphrased as follows: Thinking does not take place inside our heads but is an activity that we perform with our heads. Basically, I view artifacts as the external memory needed to accomplish almost any skilled cognitive activity. I will attempt to identify features and attributes of artifacts that make them supportive to human cognitive action, and which can be used as a design guideline for the development of interactive systems. It turns out that the principle "Reduce the amount of enforced sequentialization needed to create and embody Gestalten" can serve as a general guideline. Drawing on this view on the role of formalisms, formal artifacts or computer-based tools for human understanding and communication, I present some conclusions as to the potential opportunities and risks (and limitations) inherent in the development and use of formal artifacts, i.e. artifacts that are developed by employing formalisms.

Convergent Relativism

Kevin T. Kelly, Carnegie Mellon University, Pittsburgh (USA)

For the past twenty years, relativism has been advanced as an objection to the possibility of objective norms for inductive inquiry, of which computer modelling is a special case. Relativism, most generally, ist the thesis that truth, evidence and other features of language or reality can change as a result of actions (mental or physical) of the modelling agent. Relativism is indeed an objection to the proposal of explicit methods for enforcing rational agreement, for how can a method that forces a person to abunden his own truth for the sakes of agreement he considered rational. It is no objection to the aim of finding one's *own* truth. There is no objection that the relative truth there is if relativism is admitted. Once these considerations are understood, we see that it is possible to investigate by logical means the possibility of mechanical methods that are guaranteed to stabilize to their own version of the truth. In this presentation I provide a taxonomy of various types of relativism, and show how to demonstrate necessary and sufficient conditions for the existence of reliable procedures that converge for the relative truth.

Models and Software Metrics

Jochen Ludewig, Universität Stuttgart

A model metrics of some original system S is in some aspects similar to S. Therefore, under certain circumstances, metrics may replace S, thus allowing to perform experiments which cannot be performed with S. A model of a building, e.g. may be modified in order to learn the effects of some extensions planned for the real house.

Software metrics are special models used for describing properties of software, or of the process of software development. A metric consists of a mapping $S \rightarrow f_M(S) = v$ and an interpretation of v, where S is the software (-component), and v the value.
Metrics can be classified in several ways, e.g.: simple metrics. (direct results from counting or measuring) versus derived metrics (calculated from simple metrics); descriptive versus prognostic metrics; scalar metrics versus vectorial metrics, etc.
To date, derived metrics are not widely used, because there is no really useful, or relevant, interpretation for them. Simple metrics, like DLOC (delivered lines of code), are just as useful, and widely accepted.
Project SESAM (*S*oftware *E*ngineering *S*imulation by *A*nimated *M*odels) at Stuttgart University aims at experimenting with metrics, mainly for the development process.

Insurability of Software Related Risks

J.A. Markowsky, Dept. of Computer Science, Technion, Haifa

We discuss some problems arising from our attempts to clarify issues in *personal liability* of software and programmed frameware and hardware.
We distinguish software categories as follows: Software as a *medium*, a *service*, a *device*, a *scheduler* and a *tool*. Product liability only makes sense for the latter three. So does personal liability to some extent. We discuss the possible rate of software certification and the introduction of CPP's (Certified Public Programmers) in analogy for CAA's in accounting. We stress the rate of state, society and guilds in the emergence of a real insurance need. The absense of such a need is attributed to the self perpetuating inadequacy of software as a *driving force* of the SW-industry.
Breakthrough may come from medical applications where the FDA started to enforce standards for computer driven medical machinery.

The Metaphysics of Constructed Models

Peter Naur, Copenhagen University

Many computer programs are models of an aspect of the world, thus helping us in dealing with the world. Similar models have for centuries been successfully employed, particularly in astronomy and physics. As a consequence of the successes in these fields certain metaphysical beliefs have come to be generally accepted, such as that the models are inherent in the aspects they model, that models are true of the aspects they model, and that models tell the complete story. These metaphysical superpositions upon construct models have several harmful consequences. They support the dismissing of personal responsibility for results obtained from models, they suggest construction of models on insufficient basis, etc.

Modelling the Expert

Jeff Paris (joint work with A. Vencovská), Manchester

We consider the following problem: Given a set of knowledge statements K about a certain domain by an Expert how can we use K to predict the Expert's answers to further questions about this domain? Traditionally it has been supported that K actually is the Expert's knowledge, that K can be successfully elicited and that the Expert is using K, and only K, in generating answers to further questions about the domain.
In this talk I criticise this position by giving a 'model of an Expert' in which not only is K not the Expert's knowledge (merely an incomplete statement of it) but moreover K gives almost no information about the true knowledge or about the Expert's responses to further questions. On the other hand I shall argue that this model possesses many properties we would wish for an intelligent agent, for example the ability to be created from nascent ignorance by learning, the ability to provide answers to questions in real time whilst at the same time requiring only feasible storage space.
Whilst this is, of course, only a model and may be irrelevant to predicting the actions of human Experts, it does suggest that some common assumptions currently used to justify optimism in Expert Systems may not be above criticism.

Limits of Modelling Caused by Limits in IT-Security

Andreas Pfitzmann, Universität Hildesheim

Limits of modelling not only result from limits of formalization, computability, and expense, but may also result from limits in the security of information technological (IT) systems.
If the model is executed by an IT-system, process data related to natural persons, and has some effects on the outside world, the following security aims have to be adressed:

1. Information input to the model (and thereby entrusted to the IT-system) which cannot be deduced from the agreed upon output of the model has to stay *confidential* in a checkable way.

2. The *integrity* and *availability* (i.e. the total correctness) of the model's output will not be better than that of the underlying IT-system.

Three properties of IT-systems, which exacerbate problems, are described:

- There is no longer any technical or financial need to erase data, e.g. related to persons.
- The huge design complexity allows even *universal Trojan Horses* to go undetected forever or until it is too late.
- IT-based generation of IT-systems allows *transitive* Trojan Horses to spread along all design and execution paths.

To strive for security not only in, but *by* distributed systems (including physical distribution, operating, and design diversity) is recommended as an additional security mechanism.

Produktive Mengen

Jörg-Martin Pflüger, Universität Bremen
(short statement)

Ich versuche einen vereinheitlichenden Blick auf die verschiedenen Grenzen der 'konstruktiven' Modellierung zu gewinnen, indem ich den aus der Rekursionstheorie stammenden Begriff der produktiven Menge in metaphorischer Rede verwende. Die menschlichen Umgangsweisen mit Sprache, Logik, Modellierung, Wissen und sich selbst sind in diesem Sinne produktiv, weil jeder Versuch sie zu operationalisieren, etwas schafft, was davon nicht erfaßt wird.

Limits from a software engineering point of view

Karl-Heinz Rödiger, Universität Bremen
(short statement)

Three types of limitations are discussed. 1. Limitations due to social responsibility: No one should model systems for which she or he cannot take over responsibility (e.g. early warning systems). 2. Limitations due to certain methods and tools: History of software engineering is one of searching for methods and tools in order to overcome the software crisis. But there is "no silver bullet" with each change of methods the problems of understanding the application domain are retained. 3. Limitations due to economical and political reasons: Even if software engineers would be able to develop systems which are suitable to the task and to the users have to regard economical limitations and questions of power and control in companies.

Why we Need Error-Free Programs and why we will not get them

Heinrich Rust, Universität Karlsruhe

Computer scientists like all other humans beings have small heads. That is why they have to simplify big and complicated tasks. One way to simplify when looking at the consequences of executing a program is a restriction to mathematical correctness. If this goes too far, you forget health hazards and social consequences, any confidence in the correct function of a program then is misplaced. Intuitive understanding is the basis of confidence. Formal techniques might sometimes help when trying to reach an intuitive understanding but also this way you cannot cause to reach a correct concept. Potentially life-threatening applications require confidence and, hence, understanding. But sometimes they are too complicated. A team will have to take on the responsibility. But responsibility of a team is a strange concept to computer scientists.

The conclusion is: We will not get error-free programs because we have small heads. And we need error-free programs because we cannot take on the responsibility for big erroneous computer systems.

Modelling of Reasoning with Vague Concepts by Fuzzy Logics

Peter Schefe, Universität Hamburg

Fuzzy set theory and fuzzy logics (created by L. Zadeh) claim to provide the means for modelling reasoning with vague and non-crisp concepts and solve the classical paradoxes of the barber, the heap etc. It is argued that most of the claims are unjustified, as fuzzy set theory suffers from a insufficiency rooted in its base logics, the abolishment of the excluded middle. It is shown that one can model degrees of agreement without committing this sort of logical suicide. Beyond that, several principles and proceedures developed to model (degrees of agreement) inference involving 'fuzzy' concepts referring to continuous scales are investigated both on a base of two-valued logic and a multivalued one. It is shown that the fuzzification of the procedures – valid for the two valued case – yields amazing results (subnormal or hardly interpretable 'fuzzy stretches') that renders their application rather useless.

Methodische Probleme der KI

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Betrachten wir die Methoden der KI, so fallen zwei große Klassen auf: Fachmethoden und Logikanwendung. Welche Probleme treten dadurch auf? Wodurch?

These 1: Die rationale Rekonstruktion von Wissen und Intelligenz mit symbolischen Repräsentationen ist fragwürdig (aus philosophischen, Machbarkeits- und sozialen Gründen) und schafft dadurch Probleme im Anwendungskontext und in den Selbstdefinitionen des Menschen.

These 2: Die Abgeschlossenheit formaler Systeme schafft Probleme sowohl der Robustheit als auch der Korrektheit.

These 3: Komplexitätsprobleme machen einen operationalen Umgang mit symbolischen Repräsentationen unmöglich. Für alle uniformen Methoden der KI (Deduktion, Inferenz ...) wurden schwerwiegende Schranken der Berechenbarkeit und Komplexität gezeigt.

Konnektionistische Lösungen leiden nicht unter 1 und 2, Komplexität wird von Zeit in Richtung auf Platz verschoben, also betrachten wir die mögliche adäquatere Herangehensweise mit Nichtverifizierbarkeit, eher statistischem Verhalten, und Korrektheitsnachweis a posteriori.
Es folgt, daß der soziale Gebrauch von konnektionistischen Lösungen noch fragwürdiger und u.U. gefährlicher ist als von rational rekonstruierten.

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