Data and Knowledge Engineering
for Intelligent Information Systems

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Computer Science

- Nowadays, *computer science* is used in many application areas, including, e.g., business, industry, and internet.

- Watson is a computer system developed at IBM capable of answering questions posed in natural language, that won 1 million US Dollars on the quiz show Jeopardy! in 2011.

- Most of the code is object–oriented (Java and C++), and there are declarative parts.

- We are currently organizing a conference with a summer school on declarative programming.

Computer Science in Würzburg

The University of Würzburg has about 30.000 students,
the city has about 130.000 inhabitants.

CS Studies (each including a Thesis)

Type	Years
Bachelor	3–4
Master	2–3
PhD	3–5

CS Topics

- Databases, Artificial Intelligence, Semantic Web
- Software Engineering, Algorithms, Hardware
- Aerospace, Human Computer Interaction

Map of Europe

Germany – Castle in Würzburg (Bavaria)

Residency in Würzburg

Capital of Germany – Berlin, Brandenburg Gate

East Germany – City of Dresden

South Germany – Castle Neuschwanstein

Intelligent Information Systems

Modern intelligent information systems need to integrate hybrid knowledge bases, containing, e.g.,

- relational databases (SQL),
- post–relational databases (e.g., deductive or NoSQL),
- semantice web / linked open data.

We are investigating declarative and domain–specific languages for intelligent systems on the internet.

Internet of Things (IoT)

Multi–Paradigm Programming

- Traditional, *imperative* programming languages tell the computer exactly how to accomplish a goal.

Multi–Paradigm Programming

- Modern, *declarative* programming languages only specify the goal to the computer, e.g.
    - Database Languages,
    - Rules in Decision Support,
    - Semantic Web (ontologies).

- Imperative programming languages can profit from declarative specifications.

- We investigate integrations of declarative concepts into popular imperative languages, such as Java, JavaScript, and Python.

Applications

Rule Bases for Expert Systems

- Diagnosis in Medicine, Industry, etc.

```
if 'Processes in ERP System' = partly
then 'Processes in other Software' = partly .

if 'Existence of other Software' = yes
and 'Functionality of other Software' = increasing
and 'Acceptance of other Software' = increasing
then 'Acceptance of ERP System' = decreasing .

if 'Use of other Software' = increasing/constant
then 'Acceptance of ERP System' = decreasing .
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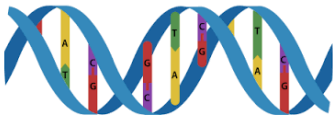
  complex rules are possible (generic, heuristic, defeasible, with default negation, ...)

- Root Cause Analysis in Computer Networks
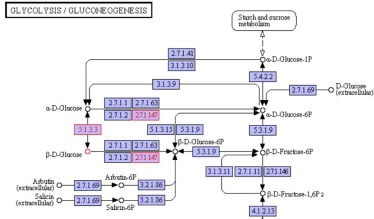- Business Rules in E–Commerce

Applications

Bioinformatics

- Language and Genome
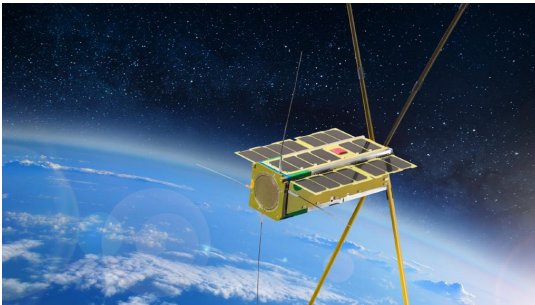- Metabolic Pathways, Drug Design

applications of reasoning

Applications

Aerospace
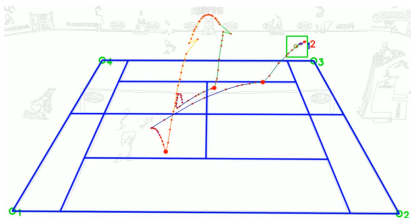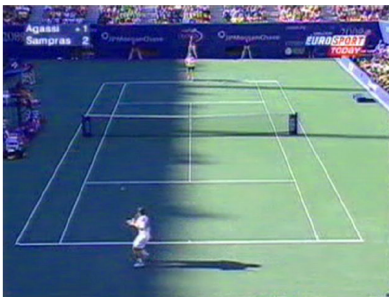
- High–Level Planning in Nano Satellites

- Code Analysis with Abstract Syntax Trees for C++

Applications

Sports

- Image Recognition – Ball Trajectories in Tennis

- Decision Support – Analysis of Tactical Behaviour

Applications

Digital Humanities

- XML / TEI Databases
- Collaborative Morpheme Annotation
- Natural Language Processing
- Kallimachos (project in digital labraries)

Conference Declare

Declarative programming is an advanced paradigm for modeling and solving complex problems, e.g., in the domains of

- data and knowledge engineering, databases,
- artificial intelligence, natural language processing,
- modeling and processing combinatorial problems,

and for establishing systems for the web.

The conference on Applications of Declarative Programming and Knowledge Management (INAP–21) is collocated with two workshops on logic programming (WLP/WFLP).

Previous INAP conferences have been held in Japan, Germany, Portugal, and Austria.

Topics of the Conference Declare

- data and knowledge engineering / management: deductive databases, rule bases, decision support, expert systems, knowledge discovery

- declarative programming: logic programming, nonmonotonic reasoning, knowledge representation, domain–specific languages

- distributed systems and the web: agents and concurrent engineering, ontologies, semantic web, internet of things

- constraints: constraint systems, CLP

- practical systems: tools for academic and industrial use, knowledge–based web services, logic solvers

- multi–paradigm programming

Summer School

Advanced Database and Logic Programming Concepts

- September 17–21, 2017
- a 5–day summer school for students and PhD students within the domains of databases, AI, and semantic web
- a complete schedule will be announced until May
  - usually teaching in the morning,
  - exercies/labs in the afternoon

Collocated with the Conference Declare

- September 19–22, 2017

Constraints and Constraint Programming

Prof. Salvador Abreu, Universidade de Évora, Portugal

- Lectures in the morning

  - Constraint Programming (complete methods),
    theory, tools and a few toy examples
  - Global constraints
  - Reified boolean constraints
  - Optimisation problems
  - Meta–heuristics and Local Search (incomplete methods)
    theory, tools and small examples

- Labs in the afternoon:

  - exams, applications

Multi–Paradigm Programming with Rules and SKE

Prof. Grzegorz J. Nalepa, AGH University, Kraków, Poland

- Lectures in the morning
  - Design of rule bases (RB)
  - Introduction to Semantic Knowledge Engineering (SKE)
  - Rules / Processes in BPMN; Context–Aware Systems
  - Rule engines on mobile devices
  - Multiple paradigms in SKE

- Labs in the afternoon:
  - SKE tools, business processes / rules, rule engine on Android, recommender systems on mobile devices

Semantic Web Knowledge Bases, Linked Open Data

Prof. Dietmar Seipel, University of Würzburg, Germany

- Introduction to the summer school
- Lectures in the morning
  - the resource description framework RDF
  - linked open data
  - the query language SPARQL
- Labs in the afternoon
  - declarative programming, the tool ClioPatria,
    SPARQL, integration into the programming language Python

Declare

Conference and Summer School Declare

- September 17–22, 2017
- `declare17.de`

Dates

- May 20: early online–registration to the summer school
- a complete schedule will be selected then
- the participants (students or PhD students) have to register; they will be enrolled as students
- June 24: paper submission to the scientific conference INAP; 6 or 15 pages (short or long)
- July 14: notification of authors

We are looking forward to welcome you in Würzburg

Thanks for your attention !