Seminars @ Knowledge-based Systems Group 184/3

WS 2017/18

Seminar Topic Assignment

Institut für Informationssysteme
Arbeitsbereich Wissensbasierte Systeme

www.kr.tuwien.ac.at
Seminar Topics

Seminars:

- Seminar in Theoretical Computer Science
- Seminar in Artificial Intelligence
- Seminar in Logic
- Seminar in Knowledge Representation and Reasoning
- Seminar in Cryptography

Topics for master seminars:

- Refutation Calculi (Tompits)
- Quantum Logic: Basics and Proof Theory (Tompits)
- Natural Language Processing
- Cognitive Psychology and its Implications (Tompits)
- History of Logic (Tompits, Eiter)
- Data and Knowledge Processing (Eiter)
- Artificial Intelligence (Eiter)
- Cryptography (Egly)
- Solvers and Proof Systems for QBFs (Egly)
- Digital Transformation and AI (Egly)
Refutation Calculi


Quantum Logic: Basics and Proof Theory


Natural Language Processing


From the Contents:

1. Semantic Analysis
2. Natural Language Generation
3. Corpus Creation
4. Part-of-Speech Tagging
5. Word Sense Disambiguation
6. An Overview of Modern Speech Recognition
7. Question Answering
8. Information Extraction
9. Report Generation
10. Ontology Construction
Cognitive Psychology and its Implications


From the Contents:

1. Perception
2. Attention and Performance
3. Mental Imagery
4. Representation of Knowledge
5. Human Memory
6. Problem Solving
7. Expertise
8. Reasoning
9. Judgement and Decision Making
10. Language Structure
11. Language Comprehension
12. Individual Differences in Cognition
Additional topics not covered in the VO History of Logic.

Topics:

1. Stoic and Megarian logic
2. Albert von Sachsen
3. Gottfried Wilhelm Leibniz (1646-1716): Works about modal logic
4. Augustus de Morgan (1806 - 1871)
5. George Boole (1815 - 1864): Analysis of Clarke and Spinoza’s ontological arguments (from “The Laws of Thought”)
6. Charles Sanders Peirce (1839 - 1914): Existential Graphs
7. The logic of Stanisław Leśniewski (1886 – 1939)
   - Abriss der Logistik, 1929.
   - Meaning and Necessity: A Study in Semantics and Modal Logic, 1947
History of Logic (II)

Logicomix
History of Logic (II)

Gödel and Carnap in Vienna, Tarski in Vienna

Gödel and Carnap in Vienna

Eckhart Köhler
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The topic I wish to deal with has to do with the historical question of how the notion of a metatheory for logic and mathematics, called a “metaplanum” by Carnap in 1954, was eventually influenced by Gödel. At the same time, I will be calling attention to some of the principle motives of Gödel’s earliest work in logic and in particular his philosophical interests at the beginning of his career. My method will be to refer primarily to Gödel’s discussions with Rudolf Carnap, who first taught Gödel logic. The interaction with Carnap is particularly instructive, for many reasons. Firstly because we have Carnap’s rather precise diary entries and notes to go on. Especially Carnap’s notes of his discussions with Gödel are interesting, because they demonstrate his effort to steer Gödel towards a more platonic position on the foundations of mathematics. Conversely we can observe how strongly and single-mindedly platonic Gödel’s views were already as a young man.

Before I begin with the relations between Gödel and Carnap, I will say a few words about their academic backgrounds. Carnap was born in 1881 in Breslau near Breslau, in the Free State of Prussia, the son of a wealthy Jewish merchant. He studied philosophy, physics, and mathematics at the University of Breslau and the University of Berlin, and in 1905 he was granted his Ph.D. degree in philosophy. After a period of study in England, he returned to Germany and began teaching philosophy at the University of Göttingen in 1907. In 1913, he went to the University of Frankfurt, where he taught until 1914, when he was drafted into the army. In 1918, he returned to Göttingen, where he taught until 1928, when he was appointed to the Chair of Logic and Philosophy of Science at the University of Bern, Switzerland. In 1933, he was forced to leave Switzerland because of his Jewish background, and he moved to the United States, where he taught at the University of California, Berkeley, from 1933 to 1963.

Gödel was born in 1906 in Brünn, Moravia, the capital of the Austro-Hungarian Empire. He moved to Vienna in 1919, where he was introduced to the Vienna Circle by his teacher, Moritz Schlick. Gödel’s early work in logic was influenced by Schlick, who was a staunch defender of the principle of the correspondence between mathematics and reality. Gödel’s early work in logic was also influenced by the work of the Russell and Whitehead, who had published their “Principia Mathematica” in 1910.

In 1929, Gödel was invited to attend the Vienna Circle on the initiative of Hans Hahn. At the time, the Vienna Circle was a discussion group led by Moritz Schlick in the mechanical drawing room of the Mathematics Department, and it was called the “Schlick-Zirkel”. 1926 was an important year for the “Zirkel”, because Carnap arrived that year, and his presence was perhaps the single most important factor in the development of the Vienna Circle, as he became its most famous, most influential, and in certain respects most radical, representative.

In 1930, Gödel published his famous paper “On Formally Undecidable Propositions of Principia Mathematica and Related Systems I”, which marked the beginning of his work on the foundations of mathematics. In this paper, Gödel proved his incompleteness theorem, which states that any consistent formal system capable of expressing basic arithmetic is incomplete, in the sense that there are true statements that cannot be proved within the system. This theorem had a profound impact on the foundations of mathematics, and it is generally considered to be one of the most important results in the history of logic.
Streaming Data

- stream query languages (CQEL, csparql, LARS, etalis,...)
- complex event processing (ETALIS, ...)
- stream reasoning
- benchmarking
- applications

Workshops on Stream Reasoning:
- TU Vienna, Nov 9-10, 2015,
- ISWC/Kobe, Oct 17, 2016 /Vienna Oct 22, 2017
- TU Berlin Dec 8, 2016; Uni Zurich, Jan 2018

Theory, systems, applications
Temporal Logics for Stream Reasoning
- linear time logic
- temporal equilibrium logic
- temporal description logics

Reasoning about actions
- planning using ASP
- agent policies
Answer Set Programming with external source access

- dlvhex system, http://www.kr.tuwien.ac.at/research/systems/dlvhex/

\[
\text{triple}(X, Y, Z) \leftarrow \text{url}(\text{File}), \& \text{rdf}[\text{File}](X, Y, Z). // \text{import RDF triples}
\]

- clingo, clingcon http://potassco.sourceforge.net/

- ASP + X, X = SMT, Description Logics, Constraint Solving, …

Theory, systems, applications

ASP with Uncertainty

- Markov Logic extensions
- Probabilistic ASP …

incremental ASP evaluation
Artificial Intelligence

- Breakthroughs in AI
  - Liberatus
  - Alpha-Go ...

- AI & Cognitive Science:
  - Can machines be conscious?

- AI Challenges:
  - AngryBirds
  - Allen AI Science Challenge
  - Winograd Scheme Challenge
  - ...

Modern hash functions like Blake, Grøstl, Keccak, . . .: Foundations and algorithms

Blockchains Theory and applications
Solvers and Proof Systems for QBFs

- QBF solving more and more important for practical application (e.g., synthesis)
- What QBF solvers are available, what is their performance?
- Papers
  - Janota, Marques-Silva: Solving QBF by clause selection, IJCAI 2015
  - Rabe, Tentrup: CAQE: A certifing QBF solver, FMCAD 2015
  - Tu et al.: QELL: QBF reasoning with extended clause learning and levelized SAT solving, SAT 2015.
Digital Transformation and AI


➢ “The 'Jobless Future' Is A Myth” (Steve Denning, Forbes) [link]