A Logic-based Approach To Multimedia Interpretation

Dissertation Presentation

Atila Kaya

Chairman: Prof. von Estorff
Reviewers: Prof. Möller
                   Prof. Neumann
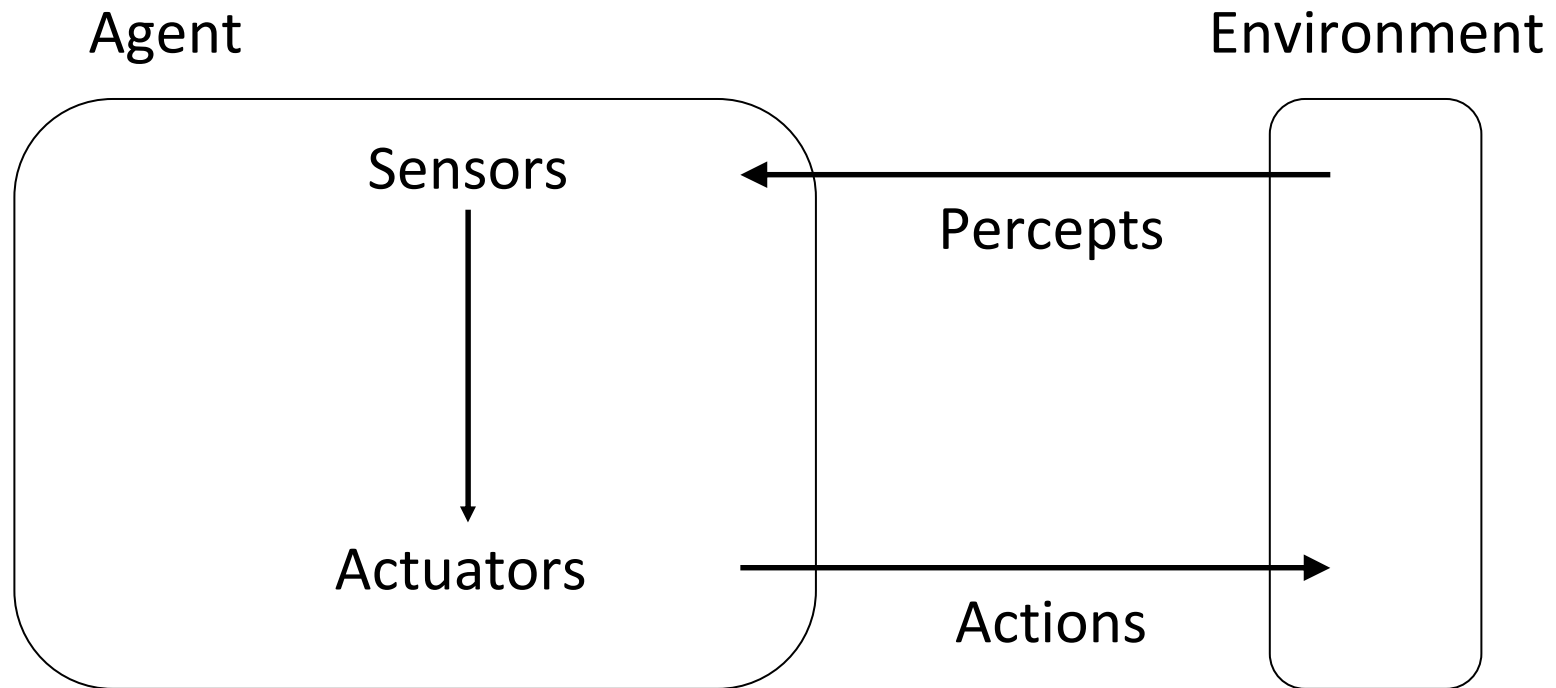   Prof. Grigat

STS

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Software
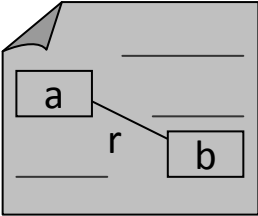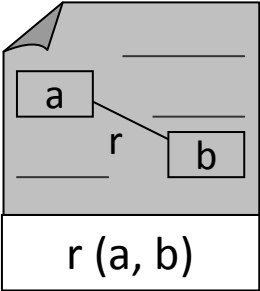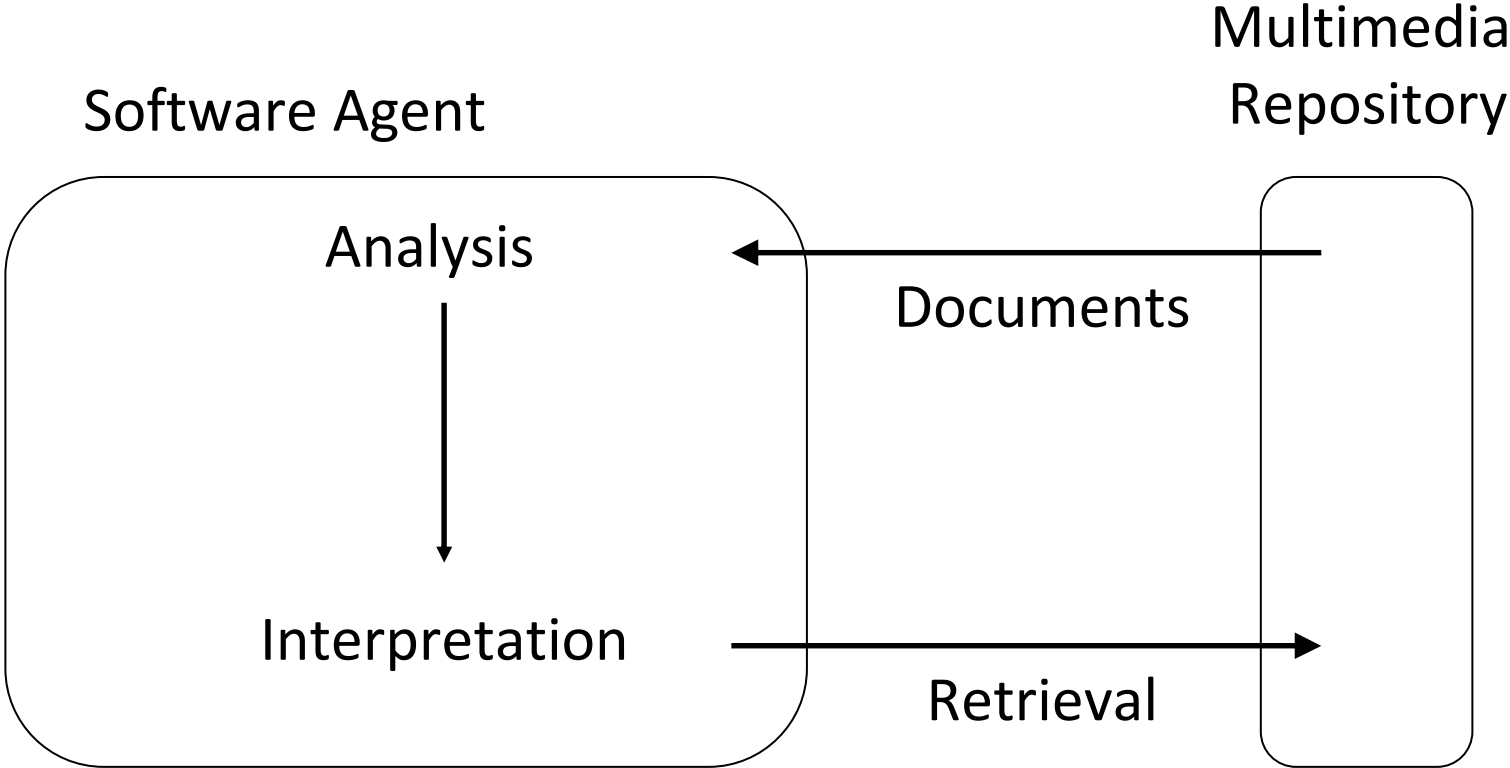Technology
Systems

Hamburg, 28th of February 2011

Agenda

- Motivation and Research Objectives
- My Approach in Detail
- Case Studies and Evaluation
- Summary and Outlook

Cognitive Robotics

Agent

Environment

Sensors

Percepts

Actuators

Actions

Multimedia Interpretation

Software Agent

Analysis

Documents

Interpretation

Retrieval

r (a, b)

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Multimedia Interpretation

Software Agent

Multimedia Repository

Analysis

Documents

Interpretation

Retrieval
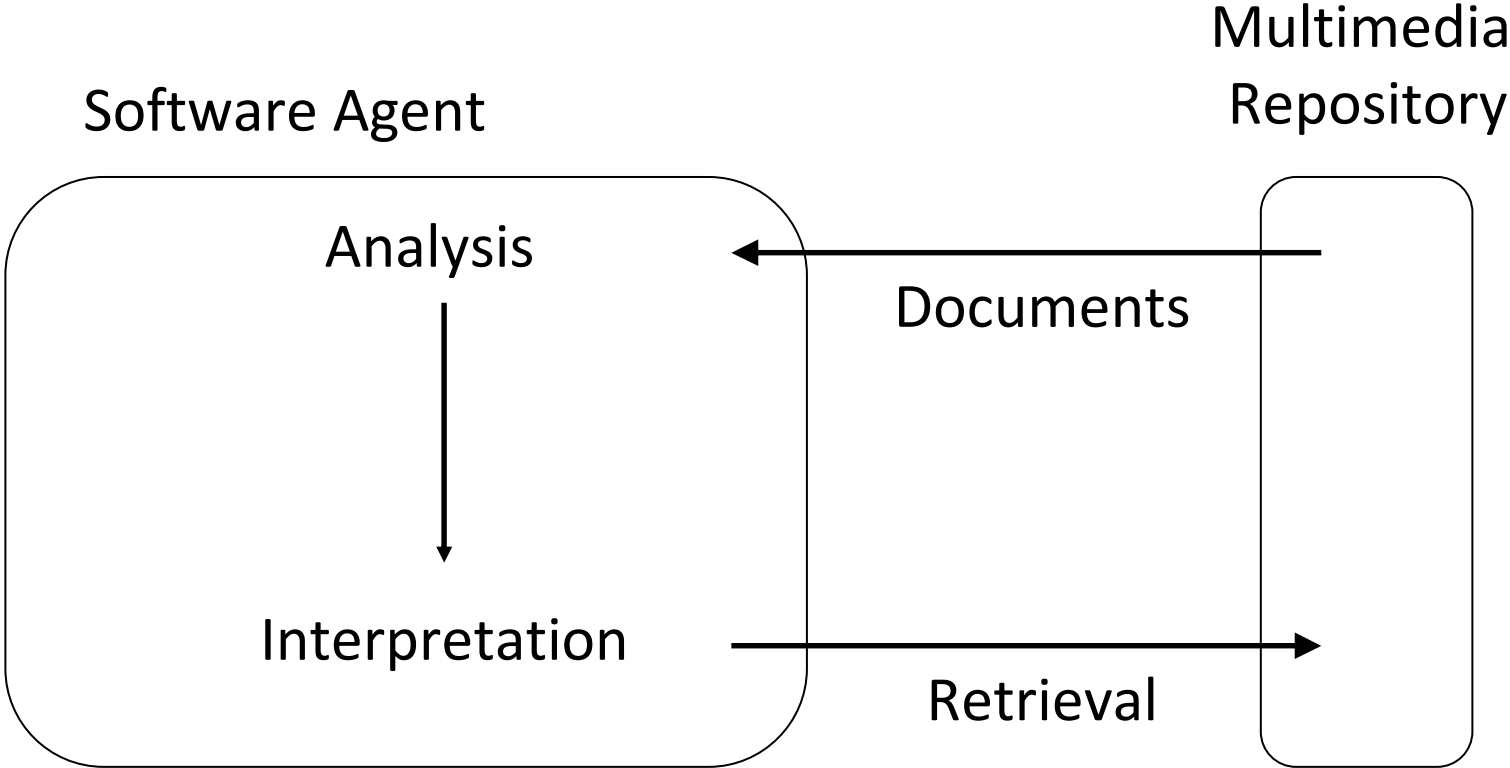
Person, Pole

Pole Vault Trial

5

Processing Pipeline

Surface-level Information Identification → symbolic descriptions → Multimedia Interpretation → deep symbolic descriptions
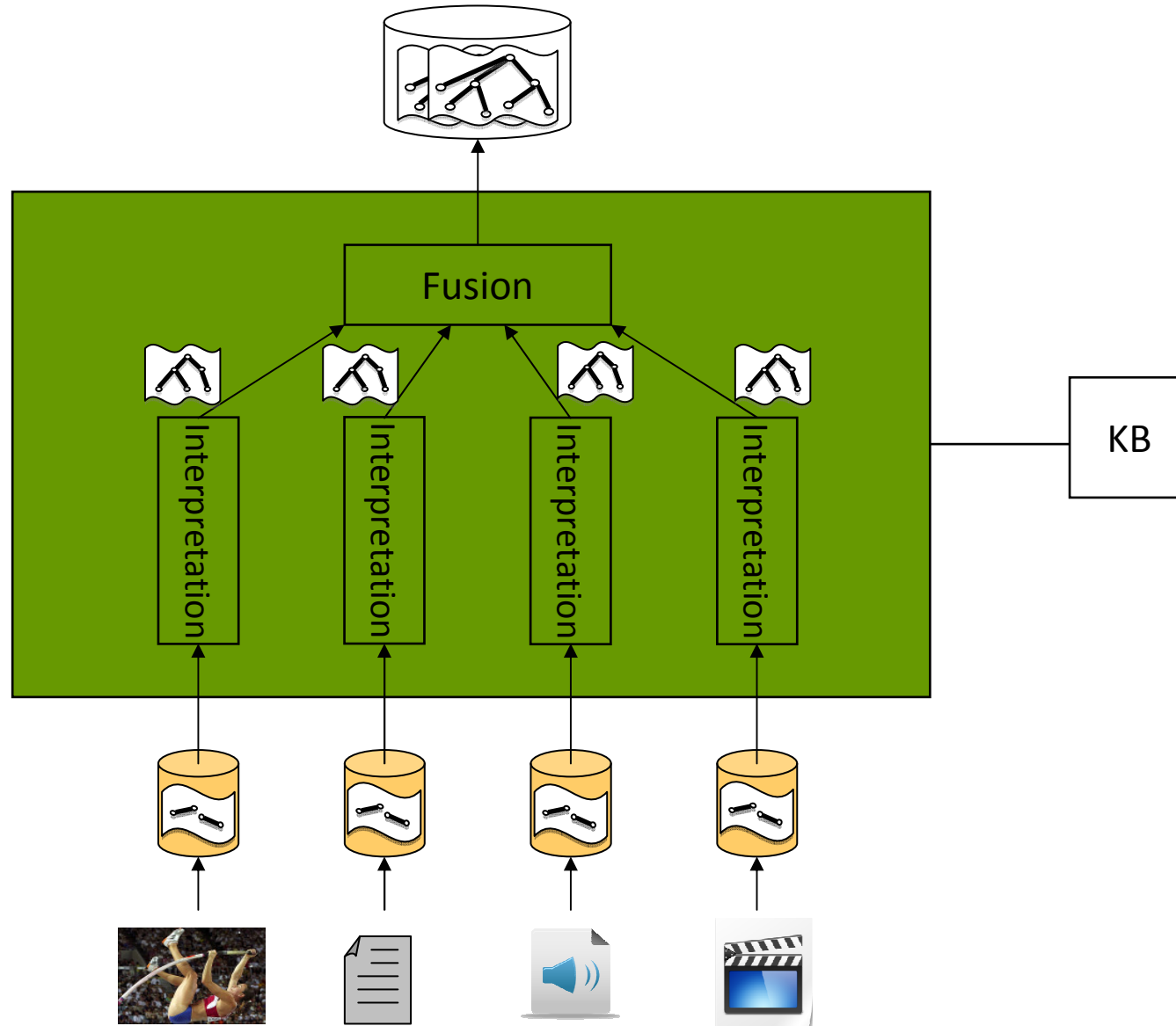
Model
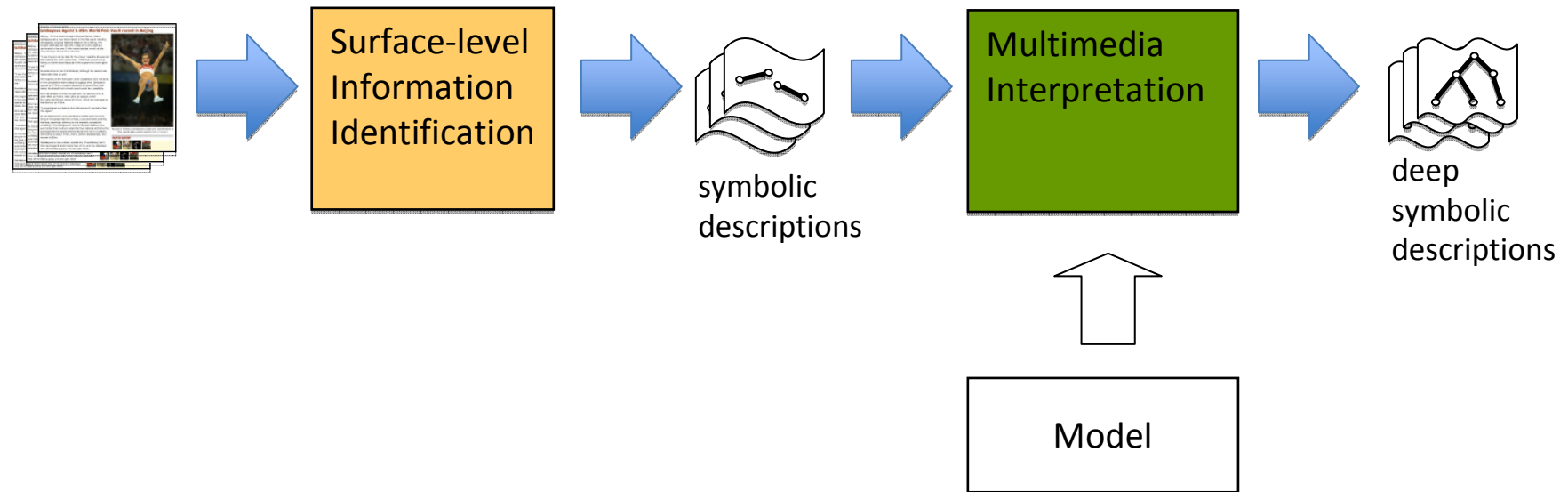
Thesis
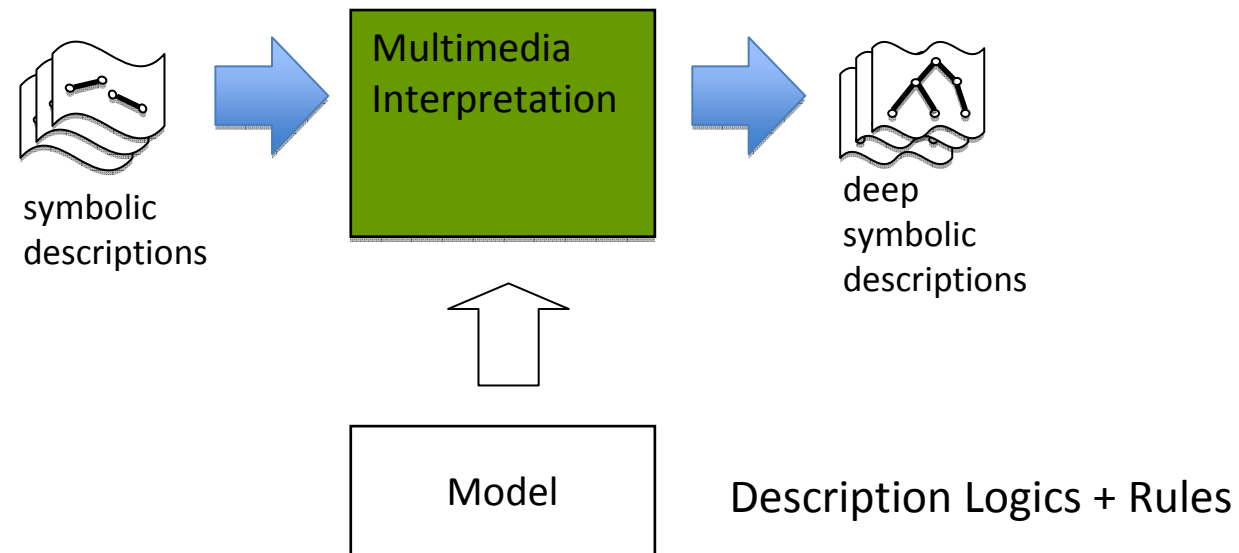
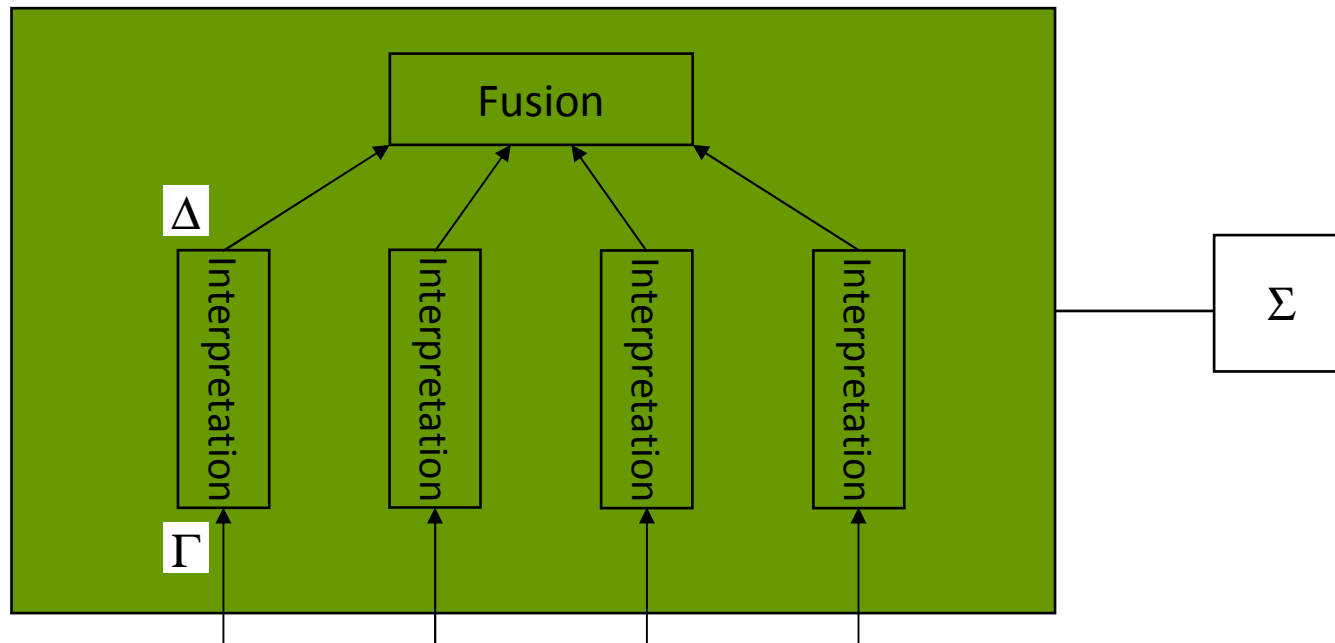- Develop a logic-based approach
- Implement & Evaluate

Multimedia Interpretation In Detail

Interpretation through abduction

Abduction Reason from observations (evidence) to explanations $\Sigma \cup \Delta \models \gamma$

Abduction: Key problems -> Solutions

- Definition of the space of abducibles

    -> Rules

- Limiting the number of explanations

    -> Preference relation

An Interpretation Example

Yelena Isinbayeva of Russia on her way to victory
(Getty Images)

Yelena Isinbayeva of Russia on her way to victory

(Getty Images)

Interpretation Example Continued

N2:Pole Vault Trial

N1:Person

F1:Face

B1:Body

P1:Pole
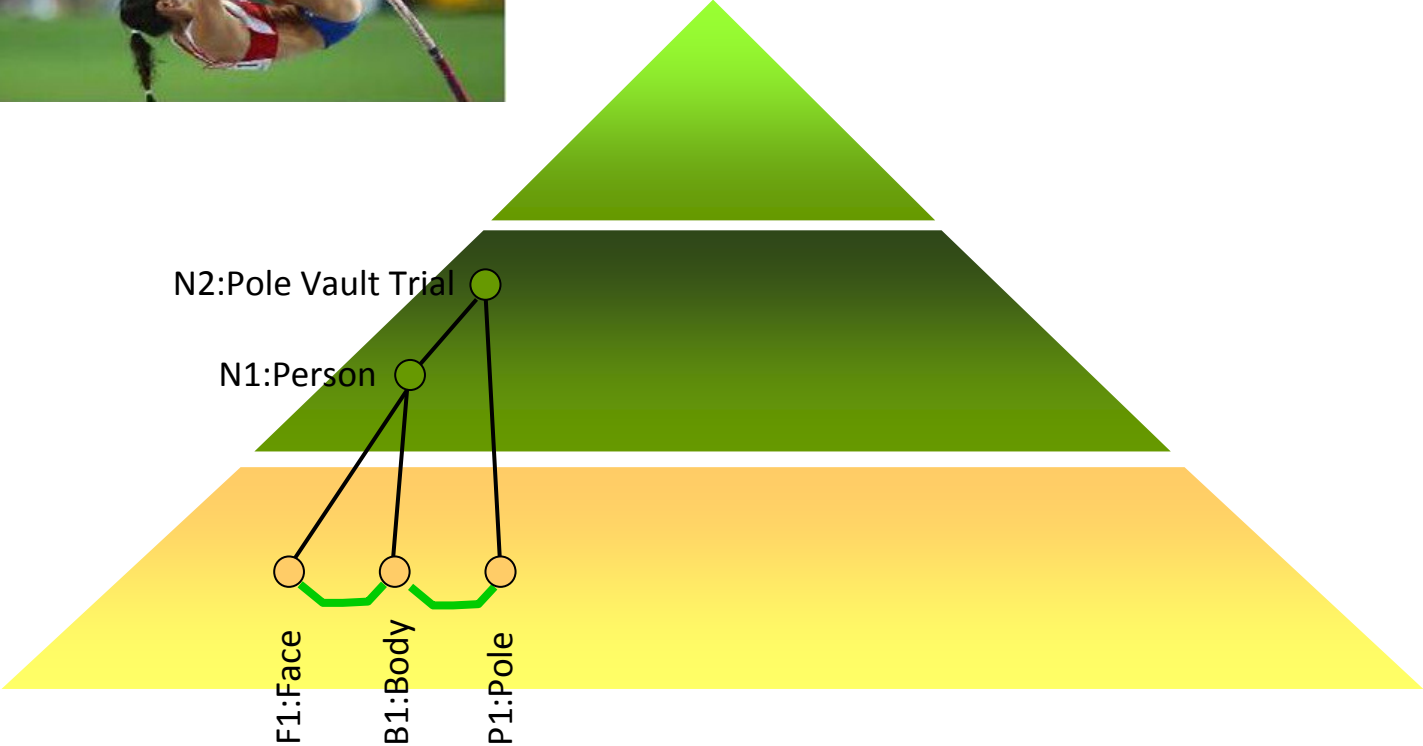
Interpretation Example Continued

Interpretation Example Continued

Yelena Isinbayeva of Russia on her way to victory
(Getty Images)

N2:Pole Vault Trial

N1:Person, Pole Vaulter

N3:Person

F1:Face

B1:Body

P1:Pole

PN1:Person Name

C1:Country Name

Interpretation Example Continued

Yelena Isinbayeva of Russia on her way to victory
(Getty Images)

N2:Pole Vault Trial

N1:Person, Pole Vaulter

N3:Person, Pole Vaulter

F1:Face

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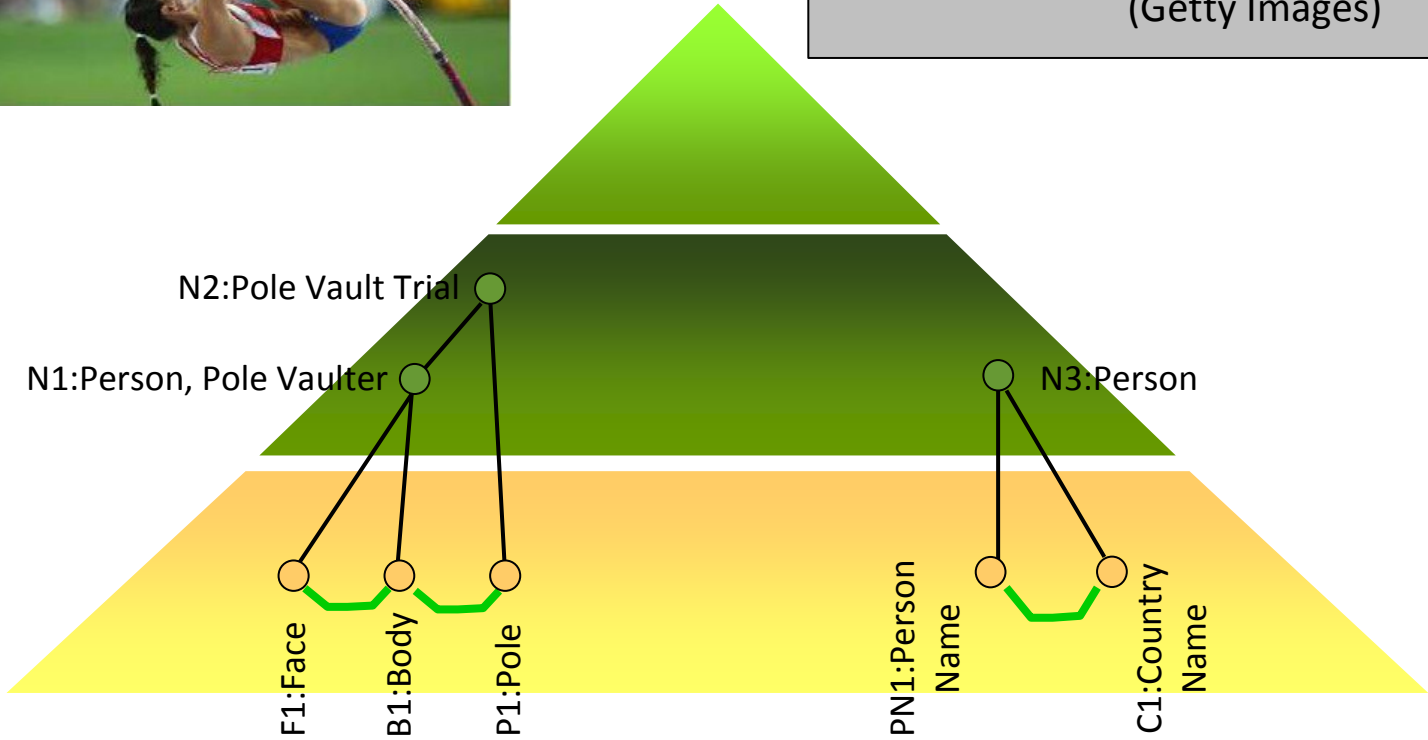
Personal Contributions

Abduction Definition of
 the preference relation & the strategy parameter

Interpretation Development & Implementation

Fusion Development & Implementation

Evaluation

Case Studies and Evaluation

Scenario Text analysis results (ABoxes) of 500 webpages with athletics news

Runtime Performance and Scalability

Time spent → runtime performance

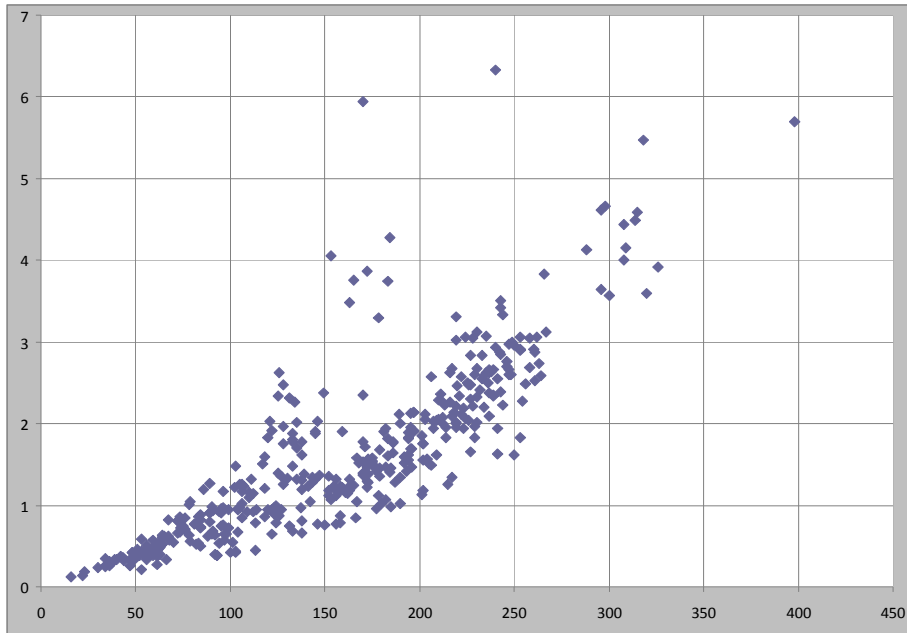Increase in analysis ABox size → scalability

Case Studies and Evaluation

x = number of fiat assertions

y = time spent in minutes
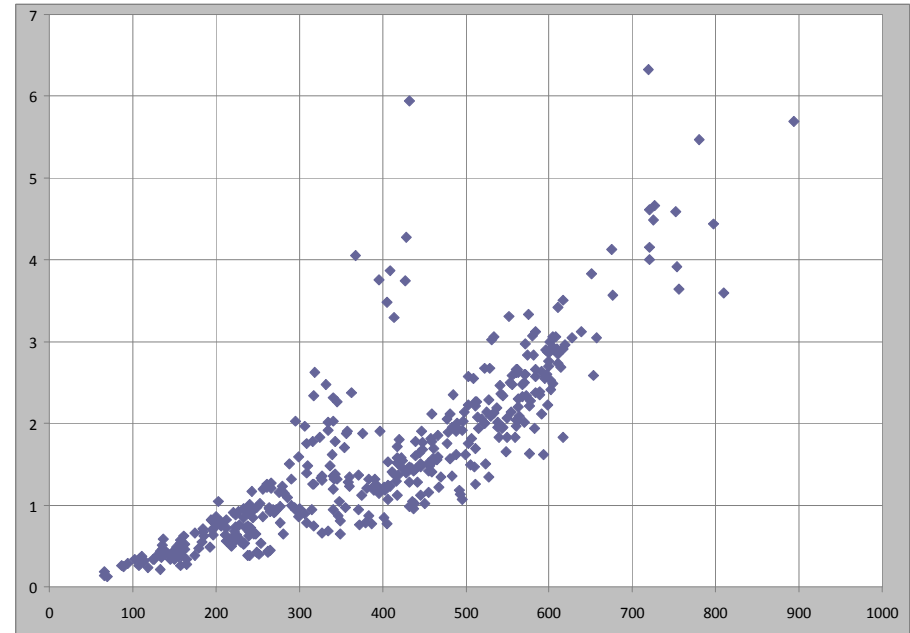
x = number of all assertions

y = time spent in minutes

Case Studies and Evaluation

Scenario 100 webpages with athletics news

Quality of Interpretation Results

Compare human-annotated versus automatically generated ABoxes (precision and recall)

Results

High-quality rich semantics descriptions

Summary

- For the MMI Problem: Solution proposed
- Several alternatives: Search space combinatorial
- Proposed solution implemented: Useful results
- Intelligent CMS (PhD Thesis Espinosa 2011)
- CASAM project
- Publications

Publications (Peer-reviewed)

Book Chapters

- S. Espinosa, A. Kaya, R. Möller. Logical Formalization of Multimedia Interpretation. *In G. Paliouras, C. D. Spyropoulos, G. Tsatsaronis, editors, Knowledge-Driven Multimedia Information Extraction and Ontology Evolution, Springer LNCS Series, To appear in 2010*

Journal Articles

- S. Castano, S. Espinosa, A. Ferrara, V. Karkaletsis, A. Kaya, R. Möller, S. Montanelli, G. Petasis and M. Wessel. Multimedia Interpretation for Dynamic Ontology Evolution. *Journal of Logic and Computation, Oxford University Press, Advance Access published on September 30, 2008. doi:10.1093/logcom/exn049*

Conference Papers

- S. Espinosa, A. Kaya and R. Möller. On Ontology Based Abduction for Text Interpretation. *In Proceedings of 9th International Conference on Intelligent Text Processing and Computational Linguistics (CICLing-2008)*, number 4919 in Lecture Notes in Computer Science, pages 194-2005, Haifa, Israel, February 2008.

Publications (Peer-reviewed)

Conference Papers

- S. Espinosa, A. Kaya, S. Melzer, R. Möller and M. Wessel. Towards a Media Interpretation Framework for the Semantic Web. *In Proceedings of the IEEE/WIC/ACM International Conference on Web Intelligence (WI'07)*, number 4919 in Lecture Notes in Computer Science, pages 374-380, Washington, DC, USA, November 2007.
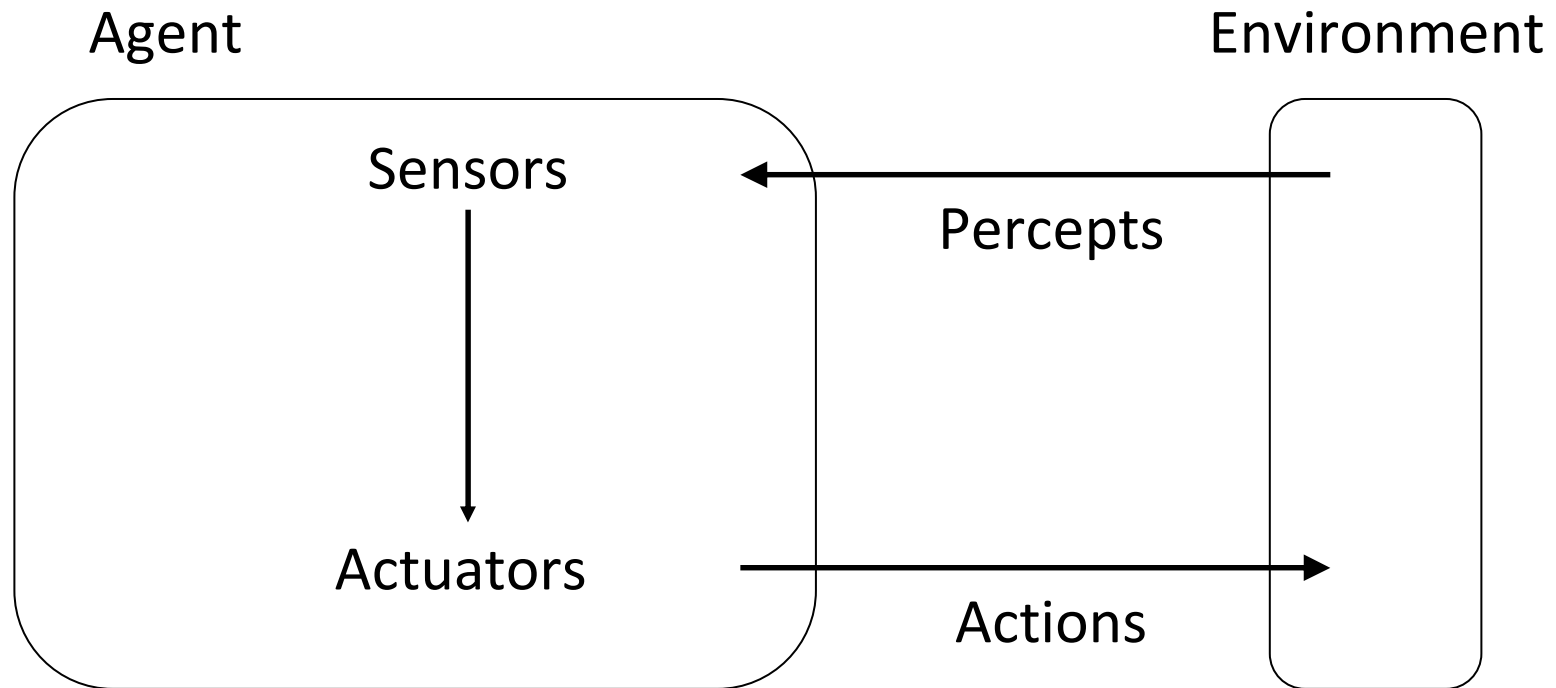
Workshop Papers

- S. Espinosa, A. Kaya and R. Möller. The BOEMIE Semantic Browser: A Semantic Application Exploiting Rich Semantic Metadata. *In Proceedings of the Applications of Semantic Technologies Workshop (AST-2009)*, Lübeck, Germany, October 2009.

- S. Espinosa, A. Kaya, and R. Möller. Formalizing Multimedia Interpretation based on Abduction over Description Logic ABoxes. *In Proceedings of International Workshop on Description Logics (DL2009)*, Oxford, UK, July 2009.

- S. Espinosa, A. Kaya, and R. Möller. Ontology and Rule Design Patterns for Multimedia Interpretation. *In Proceedings of the BOEMIE Workshop*, Koblenz, Germany, December 2008.

Publications (Peer-reviewed)

Workshop Papers

- S. Espinosa, A. Kaya, R. Möller and M. Wessel. Multimedia Interpretation as Abdcution. *In Proceedings of the International Workshop on Description Logics DL-2007*, Brixen-Bressanone, Italy, June, 2007.

- S. Castano, S. Espinosa, A. Ferrara, V. Karkaletsis, A. Kaya, S. Melzer, R. Möller, S. Montanelli and G. Petasis. Ontology Dynamics with Multimedia Information: The BOEMIE Evolution Methodology. *In Proceedings of the ESWC International Workshop on Ontology Dynamics (IWOD 07)*, Innsbruck, Austria, June 2007.

- A. Kaplunova, A. Kaya and R. Möller. Experiences with Load Balancing and Caching for Semantic Web Applications. In I. Horrocks and U. Sattler and F. Wolter, editors, *Proceedings of International Workshop on Description Logics (DL'06)*, The Lake District, UK, May 2006.

Outlook

Agent

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Actuators

Actions

Thank you for your attention