DESCRIPTION FOR THE GENERAL PUBLIC

Project: *Logics of Situations*

The main challenge in the field of Artificial Intelligence is to imitate intelligent actions in a way understandable for computers. Thus, one of the main problems in AI is to provide means to represent human reasoning in a symbolic and abstract manner. Logic offers excellent tools for expressing human-like reasoning in a computationally tractable way. Indeed, *logic has proven to be of* high importance in knowledge representation and information technology and sometimes unexpectedly practical. Perhaps the best-known example is fuzzy logic which is nowadays commonly used in control and expert systems. As human reasoning is almost always imprecise, vague, and incomplete, research on logics for knowledge representation is focused on various non-classical logics that model commonsense reasoning.

One frequently used cognitive category is *situation*. People use the word *situation* in everyday life to describe events and states in which they are, facts about the world, their thoughts, feelings, and attitudes, among others. Situations are a subject of most research inquiries. Scientists and experts try to explain or discover various types of situations: social, political, economic, historical, psychological, etc. Situations – as they are used in language – have their own properties ("He was in a new situation", "The situation was dangerous"), can be compared with each other ("These situations are the same", "His situation was different"). In many everyday circumstances, people have to determine whether a given situation holds or under which conditions a situation may arise, infer situational consequences of an actual situation or its main features. Briefly: people reason about situations. As reasoning is one of the main components of intelligence, systematic research on situations is needed.

Most research on logical representation of situations conducted so far has been oriented toward overly specialized cases with a limited scope of theoretical applications. The project aims to overcome these shortcomings: the long-term objective of the project is to design a theory of situations which will provide a conceptually elegant and unified account of the ontology of situations and inferences about them. We will draw from previously unexplored possibilities of various logical systems that have not yet been combined in the logical foundations of situations.

The main research hypothesis of the project is that the best basic formalism to devise and develop a unified logical theory of situations is the non-Fregean logic which – contrary to logics that assume *Frege's Axiom* ("Propositions are names of their truth values") – distinguishes denotations of sentences (that is, situations that sentences describe) from their truth values.

To achieve the main goal, we will develop a new generic full-fledged logical framework that can be used to represent situations and reason about them by generalizing and modifying non-Fregean logics to a sufficiently rich and powerful tool that covers the most important uses of the term *situation*. Seeking for the best logical account of situations we will study various non-classical variants of non-Fregean logic and develop new ones that benefit from different paradigms of logic, philosophy, linguistics, cognitive science, and information technology, among others.

Determining the fundamental properties of situations and establishing a new generic full-fledged logical framework for dealing with situations will enhance and advance existing logical methods in cognitive sciences. Furthermore, it will stimulate progress in the open lines of research by providing tools for representation and reasoning with all the problems in which situations play a central role.

A successful realization of the project, leading to a *unified logical theory of situations*, will yield an integrated and strong device with a wide scope of theoretical applications in cognitive science, natural language processing, information technology, and artificial intelligence in the broad sense.