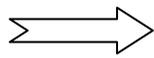


Evolution of AI models of computing in the Rasiowa – Pawlak School

Mathematical concepts and tools

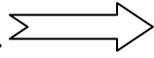
Many-valued and nonclassical logic



Approximate reasoning in distributed environments & natural computing: perception based computing

Logic	<ul style="list-style-type: none"> ➤ Computability, uncertainty natural deduction, algebraic semantics and language algebraic properties of different types of logic, especially in: <ul style="list-style-type: none"> • intuitionistic • modal • Post, intermediate • with strong negation • implicative • algorithmic • program • non Frege • with infinite logical operators ➤ Abstract logics, relationship between them and characterization of classical and other logics ➤ Hierarchy of metalogics ➤ Logical aspects programming paradigms ➤ Interpretation of logical operator in models of computation (generalized quantifiers, model operators, Post operators) 	<ul style="list-style-type: none"> ➤ Evolution of concepts: hierarchy of metalogics created by interactions with environment ➤ Society of agents, represented by a set of modal operators ➤ Consensus and emotional states as modal operators over non-classical “truth” values ➤ Logic for distributed systems ➤ Reasoning under uncertainty in distributed systems ➤ Vague concept approximation ➤ Boolean approximate reasoning: RSES ➤ Conflicts, negotiations, cooperation ➤ RS, FS, combination with nonmonotonic reasoning. ➤ Approximate reasoning about knowledge ➤ Common sense reasoning ➤ Perception logic: evolving system of interacting local logics ➤ Computational models based on perception ➤ Computational models of behavior ➤ Learning and adaptation ➤ Autonomous computing
Algebra	<ul style="list-style-type: none"> ➤ Algebraic models for nonclassical and abstract predicate calculus (Q-algebras), generalization of Rasiowa – Sikorski Lemma ➤ Lattice theory, Boolean, Heyting, Brouwer, Post and other algebras ➤ Syntax and semantics as adjoint concepts (“Galois connections”) ➤ Topos theory approach ➤ Internal representation of deduction by sheaves over closure spaces 	<ul style="list-style-type: none"> ➤ Algebraic structures for reasoning under uncertainty ➤ RS algebras, FS algebras ➤ Relational calculi ➤ Partial algebras ➤ Calculi of approximation spaces. ➤ Mereological calculi of information granules
Geometry	<ul style="list-style-type: none"> ➤ Topological properties of spaces of models and concepts ➤ „Distance” between theories which represent knowledge of agents ➤ Geometry of computations ➤ Cantor Space, as a geometric space of models for classical propositional calculus ➤ Topological interpretation of modal operators ➤ Closure spaces as generalized geometric spaces ➤ Heuristics based on geometry of computation space 	<ul style="list-style-type: none"> ➤ Measures of proximity (similarity): states and set of states of computations and concepts ➤ Similarity of cases and case-based reasoning ➤ Geometry of concepts ➤ Similarity of theories ➤ Granular space, information granulation and granular computing ➤ Discovery of granularity levels from data, e.g., relevant multivalued logics

Philosophy, CS, Biology, Psychology, Sociology, ...



Approximate reasoning about complex vague concepts and objects in distributed & dynamically changing environments

Inspirations outside mathematics