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Areas of Interest

In general I can say that I study emergence caused by complexity. For last three years I have been building the models of networks, cellular automaton, or in general the graph theory models to study complex systems, such as brains and societies. Brains of animals and humans jump from one state to another, and thus create intentional behavior unseen in any other systems. I want to understand this computational mechanism in order to build the machines which use the state transitions to compute in a brain-like fashion. Understanding the emergence in the brains, helps the understanding of the social, physical, and other systems. As such, the emergence is important for the understanding of universe.

Possible Fit Within the Institute

There are two aspects of my work. The first is the practical or engineering aspect. The animal-like thinking machines can navigate in a complex environment and recognize complex patterns, in order to execute the tasks the humans try to avoid. Also, brain-like computational principles can be used to build devices to help the disabled or impaired. The second aspect is the scientific one. It is concerned with the state transitions, which are manifested in the neural, social, and other networks. For example, social state transitions are traditionally recognized as fashion fads, revolutions, stock market crashes, and so on. Sudden changes appear in nature as well. Examples range from boiling and freezing points for water to the sudden climate changes.

Through my work, I have realized that I have to understand aspects of many different fields and that I have to be able to use my strengths to bridge different scientific groups. I see the study of complexity as a work of interdisciplinary community. Mathematicians know the language of chaos mathematics. Physicists describe and measure the systems with the tools from statistical physics. To describe societies, the insights of economists, social scientists, and psychologists are valuable. In general, the problems of complex systems are analytically not solvable, so models and computer simulations are used to obtain the knowledge. I have realized that my success relies on the connect- edness and understanding of many.

Sincerely yours,

Marko Puljic