To Whom It May Concern,

January 30, 2005

Re: Letter of Recommendation on the behalf of Marko Puljic

Marko Puljic is a doctoral student in Computer Science at the University of Memphis. He has been Research Assistant in my Computational NeuroDynamics Laboratory since 2001. Marko works on his PhD dissertation under my supervision on neuropercolation models of the dynamics of large-scale networks, to be defended in the near future. He plays a key role in establishing the foundations of this novel interdisciplinary research field, which is rapidly developing at the interface of computer science, mathematics and graph theory, neurobiology, and computational physics. With his solid scientific background in these areas, and based on his devotion to groundbreaking research, he has great potential to achieve outstanding results and to become a very productive member as tenure-track faculty. Therefore, I strongly support his application to your Department.

Marko's present research is conducted in the framework of a grant funded by NSF's Quantum and Biologically Inspired Program with the title "Percolation Model of Phase Transitions in the Central Nervous System during Perceptual Information Processing." I am the PI of this project, which builds on a collaboration between computer scientists and graph theoreticians (Prof. Bela Bollobas and Assoc. Prof. Paul Balister) from the University of Memphis, and a world-leading neuroscientist, Prof Walter J Freeman from University of California at Berkeley. This project aims at developing revolutionary novel principles of dynamical memory devices that use phase transitions for encoding and recall of data in the style of brains. The neuropercolation approach links pattern-based spatio-temporal encoding and generalized percolation in random graphs with non-local interactions. To achieve progress in this field requires, in addition to deep knowledge of computer science, also thorough knowledge and appreciation of a broad spectrum of related research disciplines. This is a very challenging task and it requires persistence and devotion. Marko has met this challenge and produced several outstanding results during the past years while staying in my Lab.

Marko's results cover several areas. He has developed a computational model of random cellular automata in two-dimensional lattices. He has studied the following models: (1) local ones, which model pure dendritic interactions; (2) and models with non-local connections, which describe biologically realistic axonal connections. These neuropercolation models are the generalizations of other dynamical models, like Conway's game of life, bootstrap percolation, and Hopfield memory arrays. The

neuropercolation model represents a generalization of Watts-Strogatz 'small-world' effects, and Albert-Barabasi and others' scale free networks. Marko's calculations are directed toward analyzing threshold phenomena in neuropercolation models, which have close similarity with phase transitions in physical systems, like Ising models. In the random neuropercolation model with non-local connections, Marko has identified phase transitions between ordered and not ordered states, which are related to paramagnetic and ferromagnetic states in physical systems. More recently, he has analyzed sustained spatio-temporal oscillations in a twin-layer of lattices with excitatory and inhibitory nodes. His dissertation summarizes his main results in this field. The obtained results are applicable to describe complex systems beyond biology, like the world-wide-web, environmental and social networks. There are a number of papers published in or submitted to journals and international conferences written or co-authored by him on this topic, including conferences as *IEEE Neural Network Conference IJCNN'03; Understanding Complexity Symposium at UI Urbana-Champaign; Int. Conf. on Cellular Automata for Research and Industry ACRI'2004,* and journals of *Complexity, Biological Cybernetics,* and *Springer Series on LNCS.*

Marko diligently cooperates with other Lab members. He also participates in the organization of the Seminars of the Computational Neurodynamics Laboratory. This often involves guiding graduate students in their studies and research. Marko also gains experience with teaching in undergraduate classes. In addition to his involvement in ongoing research, Marko has been actively involved in the preparation and submission of a new NSF grant proposal to the program on Emergent Models and Technologies of Computation EMT entitled "Pattern-Based Computing Using Noise-Mediated Phase Transition Models of Cortical Networks." He has a hands-on experience with computers, and he maintains and continuously upgrades the cluster of workstations with 16 parallel processors, which have been used for the massive parallel computations for the cellular automata.

Mr. Puljic is a highly motivated and talented young researcher working in the forefront of intelligent computing, and complexity of computational and biological networks. I am convinced that he has the qualities to become a very useful and productive member of your faculty. I strongly recommend him for the open position at your department.

Please do not hesitate to contact me if I can be of further help in your decision.

Sincerely yours,

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