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Biocomplexity Faculty Search Committee
c/o Prof. Rob de Ruyter van Steveninck
Biocomplexity Institute
Indiana University
Swain Hall West 117
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Dear Search Committee:

I am writing to recommend, with great enthusiasm, Dr. Zhiyong Yang who has applied for a junior faculty position in your department.

Let me begin by saying that in terms of raw intellectual power and the potential for making a major contribution to neuroscience, Zhiyong comes out at the top of the list of the many postdocs and students I've had over the years. He is simply off-scale in his ability to understand complex problems and to rationalize them in terms of mathematics, computer modeling, and statistical theory. His intention in his own lab is to apply these several increasingly mainstream approaches and talents to issues in neuroscience. And, during the three years that he has now spent in my lab, he has become quite sophisticated in identifying what some of the key problems in neuroscience actually are.

To briefly summarize Zhiyong's career, he attended Beijing Normal University where he achieved an outstanding record as one of the premier students in this highly competitive contingent. In 1997, he received his doctorate in computer vision from the Chinese Academy of Sciences, and went on to do post-doctoral work, first with David Mumford at Brown University working in the pattern theory group there, and then at the University of Arizona with Richard Zemel where he worked on a probabilistic model for combining visual information. Since coming to my lab in 1999, he has been exploring the basis of visual motion, visual space and most recently the relationship between luminance and brightness. A major puzzle in motion is the obvious discrepancy between the physical nature of the stimulus and what human observers actually see. Thus it has long been known that a sequence of retinal images cannot uniquely define the physical source of the stimulus. Nonetheless, human observers accurately respond to moving stimuli, indicating by both perception and behavior that they can routinely identify the correct source among an infinite array of possibilities. How this determination can occur has long been a mystery. Using both his mathematical and computational skills, Zhiyong developed a probabilistic model that argues, correctly I think, that the way the visual system solves this problem is to have retinal stimuli trigger patterns of cortical activity that are, effectively, the probability distributions of the possible sources of the stimulus. Using this framework, Zhiyong

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has been able to predict precisely what people see in response to moving stimuli in a wide range of experimental situations. His two papers on motion, which appeared in *PNAS* and *Perception,* establish a complete and thoroughly logical explanation of the statistical basis for relatively simple motion stimuli that applies, in principle, to any motion stimulus.

In his more recent work on the geometrical relation between generative sources and the corresponding retinal images, he has used a database of natural images obtained by laser range scanning to show that the statistical arrangement of objects in the world with respect to their retinal projections can explain otherwise puzzling anomalies in distance perception, and this work has recently been published in *Nature Neuroscience*. His latest effort is a brilliant demonstration of how luminance is perceived based on an analysis of a very large natural image database (the first of several papers on this topic have just been submitted). In each case, the work simply would not have happened without Zhiyong's intellect and drive for success.

The implications of the probabilistic strategy of visual perception based on this work are wide-ranging, and Zhiyong is in a good position to pursue these issues during the initial phase of his independent career, as his application makes clear. Basically, his intention is to broaden the scope of this probabilistic/empirical theory of vision to explore the anatomical structure and receptive field properties of V1 and higher order visual areas in these terms. This is an extraordinarily ambitious goal, but one I think he will eventually achieve. He is determined to relate these probabilistic analyses based on psychophysics and modeling to an increasingly neurobiological framework, with the aim of explaining the major features of visual cortical organization on this basis. There is no one, in my opinion, more likely to succeed in this than Zhiyong.

Finally, Zhiyong more than holds his own presenting and discussing his work or that of others, and has given excellent seminars and lab meetings. His intellectual integrity and zeal will make him a good teacher, despite the fact that English is his second language.

In summary, Zhiyong is an outstanding candidate who has an excellent chance of making a major contribution to understanding brain structure and function. He is a brilliant scientist who will continue to succeed.

Yours sincerely,

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