Duke University Medical Center

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Biocomplexity Faculty Search Committee
c/o Prof. Rob de Ruyter van Steveninck
Biocomplexity Institute
Indiana University
Swain Hall West 117
Bloomington IN, 47405-7105

Dear Colleague:

It is my pleasure to write in support of Dr. Zhiyong Yang who is applying for a research faculty position in your department. Over the past several years I have collaborated with Dale Purves on studies using non-invasive fMRI brain imaging to study the functional anatomy of the visual cortex. As part of that collaboration I have regularly attended the weekly Purves lab meetings, where I have gotten to know Zhiyong and his work. Those weekly sessions have provided many lively discussions of the empirical theory of visual perception that is the main thrust of the research in the Purves lab. At those sessions I have also had the opportunity to participate in regular detailed discussions of Zhiyong's own work and research plans.

Zhiyong's research in the Purves lab has addressed a basic question in vision: how can the brain extract information about the sources underlying visual stimuli, where the sources themselves are unknowable in any direct sense? Zhiyong's approach to this problem has been to explore the hypothesis that the visual system solves the problem by a probabilistic strategy in which perception is directly related to the probability of occurrence of the physical sources of the stimulus. Documenting this simple idea, which the Purves lab refers to as the empirical theory of vision, has been a challenge, particularly as few mainstream vision scientists have embraced probabilistic theories. Developing and confirming a probabilistic theory of visual perception requires a good understanding of visual perceptual phenomenology, creative thinking, and competence in probability theory and statistical computing. Zhiyong has all these capabilities and has made good progress towards this goal.

His first project in this area was to determine the possible physical motions of a real world object that could have given rise to a simple moving visual stimulus. Zhiyong showed that a wholly probabilistic strategy of vision can be applied to determine the most probable physical source underlying a particular stimulus. Motion of the most probable physical source agrees quite well with what subjects actually perceive in a variety of contexts. He then applied probabilistic methods to analyze the statistics of 3-dimensional images (color photographs with range-finder distance data for every pixel) of natural scenes. His results document that, on average, visual scenes that humans normally experience have a curved 3-dimensional shape, in which distance from the observer increases non-linearly as one moves from lower to higher visual field locations. By superimposing simple visual stimuli onto this empirical probabilistic map of visual space, he showed that the shape of this probabilistic space predicts that visual stimuli that

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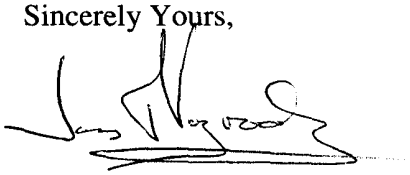
appear as co-linear line segments in the image plane would be perceived as vertically displaced, because that would be the most probable relationship of real-world sources that would give rise to such a stimulus. He showed that the predictions of this model accurately explain the misperception of co-linear line segments in the well-known Poggendorf illusion. More recently, he has used probabilistic methods to address the statistical structure of luminance in natural scenes and its relation to brightness perception. His published results showed that a wide range of visual illusions involving apparent brightness can be predicted based on a wholly probabilistic analysis of naturally occurring images.

In all of his studies Zhiyong has demonstrated an impressive ability to combine his considerable intelligence and enthusiasm with his strong skills in mathematics, theoretical physics and computer vision, and a solid knowledge of visual psychophysics and neurobiology. As an outsider to the lab I entered many of the discussions of his work with a certain amount of skepticism over both the methods applied and their usefulness, but in every case I left impressed by Zhiyong's insights and by the power and elegance of his approach. Understanding the statistics of visual stimuli and their probabilistic relationship to visual perception is not a simple task, but I have become convinced that it is something that needs to be done if we are to understand the neurobiology of vision. Zhiyong has a clear vision of how he wants to pursue this goal, and I believe he has the talent and enthusiasm to see it through.

I have enjoyed my interactions with Zhiyong here at Duke and consider him a valued colleague. Although his background, both scientific and cultural, have at times made it initially a bit difficult to communicate his ideas, through working with Dale Purves he has learned to express himself with less reliance on purely mathematical descriptions and greater attention to communicating more intuitive explanations. On a personal level I have found him to be very pleasant and highly respectful of other people, while at the same time quite straightforward about his views and opinions. Although soft spoken, his English is excellent and in my experience his ideas are always worth hearing. I believe that he would make a good faculty member and I strongly support his candidacy. If I could be of any further assistance please feel free to contact me.

Sincerely Yours,



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