THE AUTHOR FILE

Erik Meijering

A bass guitar helps a scientist-engineer promote transparency for bioimage analysis.

His inbox holds around 2,000 e-mails related to a recent competition comparing methods to track particles in time-lapse microscopy biological-image

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data. Erik Meijering, a researcher in the biomedical-imaging group at Erasmus University Medical Center in Rotterdam, co-organized the competition with Institut Pasteur researcher Jean-Christophe Olivo-Marin, whom he has known for over a decade.

Everyone wanted their method to win, says Meijering, and yet the competition atmosphere was great. “Perhaps it’s because this is hard science,” he says. “I guess that humbles people.” As it turns out, he says, no one method “does it all,” so researchers need to carefully select the ones that work best for their data. The data can be about various molecular complexes, or ‘particles’, in a cell, and tracking them implies many types of movement: free diffusion through the cytoplasm, ‘random walks’, linear active transport, or the stop and start of a particle moving to fulfill a cellular duty and then traveling on.

A few aspects make or break a particle tracking method, he says. Analysis approaches are based on assumptions about the data and on theory expressed mathematically, all of which software approximates. Parameters must be tuned to a given data set, although one day that task might be automatic.

Meijering hopes the competition contributes to the development of methods as well as transparency and objectivity in image analysis. “The wheel has been reinvented too many times in this field,” he says. For decades, researchers published methods that were tested on too few images and could tweak results to show superiority. The many existing methods indicate that the discipline is “still in its infancy,” he says.

Looking at their results, the organizers realized how gargantuan the data were. They tried averaging, within each scenario and across all particle density and signal-to-noise levels. But they ran into statistics issues. They decided to present measurements as raw numbers and graphs, indicating a top-three in each instance. This approach got them closer to “the naked truth” about how the methods performed. But it also shed a different light on some methods initially thought to have per-

formed well, which greatly disappointed some of the teams.

“A competition is so very different from a normal study,” says Meijering. In a study, a team can add experiments and try different analyses. But in a competition all details and rules have to be clarified up front. The organizers defined the data and the evaluation criteria, but, he says self-critically, “we could have done a better job” in summarizing the thousands of results.

Meijering calls himself a blend between a scientist and an engineer. His multidisciplinary approach to thinking began with childhood interests in the universe, computers and music. He had a “deep desire to understand how things work” and to create technology.

Since his teenage days, Meijering has played acoustic and bass guitars, and he performs regularly with a band, most recently for a church audience of 1,000 people.

“Making music has always been a great way to relax,” he says. “It gives you new energy and ideas.” He likes both classical and pop music and slightly prefers bass guitars. To make great music, you need both harmonic and rhythmic instruments with the bass bridging the two, he says. “Now that I think of it, that is pretty much what I’m doing in my professional life, too,” he adds, as his work bridges both computer science and biology.

Meijering studied electrical engineering at Delft University of Technology with a focus on information theory. He gravitated to signal- and image-processing technologies for medical applications for his PhD at the Utrecht University. During his postdoctoral fellowship at the Swiss École Polytechnique Fédérale de Lausanne (EPFL), he created NeuronJ, software for digital neuron tracing.

Michael Unser, his EPFL advisor, likes that Meijering made sure the tool met the needs of scientists, was validated on real data and was user-friendly. “I think that we can credit Erik for introducing such good practice in the field of bioimage informatics,” Unser says. Meijering, who is creative and thorough in his experimental design, has been an “early, enthusiastic” proponent of public-domain software and reproducible research.

“He is honest, reliable with a deep sense of scholarship—someone you can really trust and who attends to details,” says Unser. A competition calls for a carefully crafted validation protocol for the participants. “Erik Meijering is probably the most qualified researcher in the field to lead such a major undertaking.”

Vivien Marx

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Chenouard, N. *et al.* Objective comparison of particle tracking methods. *Nat. Methods* **11**, 281–289 (2014).