A continuous model of the rod photoreceptor: Towards a functional study of the retinal first logical layer.

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Given the intricacies of the retinal neural circuit, which bears a striking resemblance to that of the brain, it is proposed that retinal function goes beyond mere spatio-temporal prefiltering. Aspects related to motion detection and discrimination, anticipation and adaptation which have traditionally been ascribed to the brain are expressed in the eye (Gollisch & Meister, 2010, *Neuron, 65, 150-164*). Such early computations may be dependent on compensative and adaptive mechanisms that stem from qualities intrinsic to the retinal neural circuit (transduction time, temporal dynamic, etc).
With a view to investigating mechanisms surrounding the rods population in natural conditions, we present a mathematical, qualitative model of the rod photoreceptor and its phototransduction process. We hypothesise that characteristic features, such as temporal dynamic and filtering capabilities, may be crucial for the processing occurring within the retina. To approximate a natural setup, we used self organisation techniques to generate a neural layout matching retinal density and in vivo photoreceptor distribution (Curcio & al., 1990, *J Comp Neurol*, 292:497-523). Using both our rod model and a horizontal cell representation, we here aim to highlight the amount of data perceived by the retina exposed to scotopic natural images and the spatial compensative mechanisms resulting from the rod position patterns. Going beyond validation from data fitting, we further evaluate the parameter space of our model by examining the qualitative specification of each variable (Marder & Taylor, 2011, *Nat NSci, 14, 133-138*).

Keywords : photoreceptor; rod; mathematical modelling; retina; parameter-sensitivity analysis; self-organisation; data quantification