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Groebner Bases of Neural Ideals

Abstract: The neural ideal was introduced recently as an algebraic object that can be used to better understand the combinatorial structure of neural codes. Every neural ideal has a particular generating set, called the canonical form, that directly encodes a minimal description of the receptive field structure intrinsic to the neural code. On the other hand, for a given monomial order, any polynomial ideal is also generated by its unique (reduced) Groebner basis with respect to that monomial order. How are these two types of generating sets - canonical forms and Groebner bases - related? In this talk, we will demonstrate that when the canonical form of the neural ideal is a Groebner basis, it is the universal Groebner basis. A natural question to pursue, then, is under what conditions will the canonical form be a Groebner basis? We will give some partial answers to this question. This is joint work with numerous co-authors, including Rebecca Garcia, Kaitlyn Phillipson, and Anne Shiu