SELVI KARA, Bryn Mawr College
Algebraic Study of Polarized Neural Ideals

Neural codes, collections of binary strings representing the firing patterns of neurons, can be studied algebraically through their associated neural ideals. These ideals encode receptive field relationships among neurons in a stimulus space. However, neural ideals are not necessarily monomial (not even homogeneous) and do not yield standard graded invariants. We study their polarization, yielding squarefree monomial ideals that preserve combinatorial structure. Focusing on these polar neural ideals, we compute and bound their graded Betti numbers, projective dimensions, and regularity. In particular, we prove an upper bound on projective dimension for polar neural ideals on n neurons and classify when this bound is attained. This is joint work with Ellie Lew.