Quantitative geometry is a broad field concerned with geometric problems in which quantitative properties play a central role. My research investigates questions of this type from quantitative topology, and from geometric analysis. I will describe some of these problems, sketch the main ideas involved in their solutions, and discuss future directions.

In particular, I will answer the following questions. Suppose that two simple closed curves in a Riemannian surface are homotopic through curves of length less than \( L \). Are they isotopic through curves obeying the same length bound? Suppose that \( f : X \to Y \) is a null-homotopic map with Lipschitz constant \( L \). Under what conditions does there exist an \( L \)-Lipschitz null-homotopy? If \( M \) is a null-cobordant manifold, then how complex must a manifold which fills \( M \) be? If the Coulomb energy of a set is close to maximal, then does the set have to be close to a ball? What are the isoperimetric regions in \( \mathbb{R}^n \) with a density that is smooth, radially symmetric, and log-convex? Do non-compact complete manifolds of finite volume contain minimal hypersurfaces?