1163-65-637 **John Harlim*** (`jharlim@psu.edu`), 109 McAllister Bldg, University Park, PA 16802. *Ghost points diffusion maps for solving PDEs on manifolds with classical boundary conditions.*

In this talk, I will discuss recent efforts in using the Diffusion Maps (DM) algorithm to solve elliptic PDEs on unknown manifolds using point clouds data. The key idea rests on the fact that away from the boundary, the second-order elliptic differential operators can be approximated by integral operators defined with appropriate Gaussian kernels. The key advantage of such an approximation is that one can avoid parameterizing the manifold, which can be complicated if the manifold is embedded in a high-dimensional ambient space. On manifolds with boundary, however, such an approximation is only valid for functions that satisfy the Neumann boundary condition. Motivated by the classical ghost-point correction in the finite-difference method for solving Neumann problems, we extend the diffusion maps algorithm with ghost points such that it is a consistent estimator in the pointwise sense even near the boundary. Applying the proposed algorithm, which we called the Ghost Points Diffusion Maps, to solve the well-posed elliptic PDEs with Dirichlet, Neumann, or Robin boundary conditions, we establish the convergence of the approximate solution under appropriate smoothness assumptions. Supporting numerical examples of problems on various known and unknown manifolds will be shown. (Received September 10, 2020)