The robustness of a mathematical method determines its utility. Just imagine designing a communication network that fails to account for topological perturbations, or modeling an epidemic with strictly deterministic differential equations. My goal, then, is to study robust methods in algebraic topology and apply them in abstract and computational settings.

For example, consider training an AI to distinguish the tone signature of different musical instruments. Applying persistent homology, we associate holes in an audio recording's time-delay phase-space with a sample statistic: the persistent rank function (PRF). Corresponding with Nikki Sanderson at CU Boulder, I learned a computer trained on PRFs more accurately classifies tones than one trained on Fast Fourier Transforms. Here, a topological invariant answers the question "which instrument?" with higher fidelity than a recording's frequency tranform.

My research interest stems from (i) my exposure to topology and its applications as a college senior, and (ii) insight from two years of service work since graduating.

Advised by Dr. Jonny Comes, my senior independent study[1] examined how Galois theory constrains the solution space of Fuchsian-type DiffEqs. Following Michio Kuga, we developed a correspondence between the fundamental group on $D = \mathbf{C} \setminus \{x_1, \ldots, x_n\}$ and this region's universal covering space $\tilde{D}$. Exploiting the representation of the group of covering transformations $\Gamma(\tilde{D} \to \tilde{D})$ as a group of linear automorphisms, I parameterized solutions to the hypergeometric DiffEq. For interesting cases, I found the monodromy representation at singular points, and generated plots. I presented my method, its history, and an application to fluid flow at The College of Idaho's 2016 student research conference. At the same time, I studied point-set topology under Dr. Dave Rosoff. He led seminar in a modified Moore method. I reasoned from counter examples, finding errata in our notes by discovering non-intuitive spaces. We drew out analogies from topology to introduce category theory. I am enthusiastic to build from this ground to higher results, one of which I reached in my senior study, another of which Nikki Sanderson demonstrated ahead of me.

I gained insight to the necessity of *applications* by completing two years of service work. In Houston, under Shaoli Bhadra, I developed scalable resources for refugee case management. I crowd-sourced a map of clinics and languages spoken with the Google Maps API. I wrote bug reports for the implementation of a SQL case-notes database, and, when Texas cut funding for Refugee Medical Assistance, I contributed to a data management plan for the small refugee population transitioning from state to federal medical care. In Olympia, I am coordinating the volunteer program for a 24/7 homeless shelter. I rely on a transparent workflow and I have become a staunch advocate for "deploying early and often". I built volunteer.fscss.org to coordinate a schedule of events; it now doubles as a wiki and an open notebook. As we rely on interns and work-studies to keep the shelter open, I also am collaborating with the Evergreen State College to mentor students in service learning projects.

I am serious, however, to pursue higher education. To prepare for graduate study, I have enrolled in correspondence courses at the University of Idaho. By May 2018, I will have reviewed differential equations, probability and numerical analysis. I am also reading from Hatcher's *Algebraic Topology*, surveying topics in Gower's *Companion to Mathematics*, and building a base of computing skills in the UNIX philosophy.

While I am open to the breadth of mathematical inquiry at Washington State University, my experience with scientific computing and my topological intuition leads naturally towards topological data analysis. My career aspiration is to become an applied mathematician, researching, for example, machine learning, or biomimetic architecture. To this end, I am interested in optimization and control problems. Having surveyed their recent publications and webpages, I would gladly collaborate with Profs Krishnamoorthy, Asaki, or Vixie (and potentially with Kalyanaraman across departments). For these reasons, I believe the doctoral program in mathematics at Washington State University would be a great fit for my interests.

Lastly, I have a mild preference to study at the Vancouver campus; I am willing to submit a *statement on teaching and learning* in order to obtain a competitive teaching assistantship there.

[1] C. Grainger, Applications of Galois Theory: Monodromy Groups and Fuchsian DiffEqs, College of Idaho SRC, 2016.