ECE 513: Vector Space Signal Processing  
Spring 2021  
Final Projects

The final projects in ECE 513 provide you an opportunity to independently study a research topic of your choice that is related to the course materials. The final projects contribute 30% to the total grade.

On the Project webpage, you will find a link to a list of suggested papers for the projects. **These are only the starting points.** In many cases, further consultation of key papers in the references will be required.

A project can align with your current research. In that case, it is important that **what you present for evaluation in ECE 513 is material that you develop during the course, and specifically for the course.** You will need to provide a statement clarifying the scope of and the connection if any between the ECE 513 project and your current research.

**Project Contents**

1. Your objective in the project is two-fold:
   a. Demonstrate that
      i. You have absorbed the material of ECE513. In general, your project should demonstrate that you have developed an understanding of general (including infinite dimensional) linear spaces at the level of the course. This can be achieved by selecting papers that explicitly deal with a general vector space (including infinite dimensional setting), or papers involving random variables, and interpreting them in your project in the context of a Hilbert space of random variables. If the papers you select are all in a finite dimensional setting, then you need to get approval for using them for your project (this may be approved if the paper is challenging enough as is, and/or you will discuss the infinite dimensional setting in your project.)
      ii. You can apply the concepts and tools learned to understand an advanced related topic in a mathematically-oriented journal
      iii. You can apply what you learned in the course and from the assigned reading for the project to a new problem or new data (optional).
   b. To teach the class a topic that expands and illustrates the applications of the material of the course.

2. All projects should contain novel work. For example, it could be applying ECE 513 theoretical tools to analyze the studied method (or a simplified version of it), implementing two related methods and providing comparison, applying the studied technique to a new problem, providing new illustrative examples or test cases to gain more insight of the studied method, or running simulation on different test data.

3. Your project should be a critical summary of your main source, possibly using additional references as needed to clarify, expand, or illustrate by application.

4. Your report and/or presentation should not duplicate every point and step of the main reference, in the order it appears in the reference. Instead, your project should be a **synthesis** of what you
learned in the course, with the material you read. Thus, you should connect the material to concepts discussed in the class, such as LVS, NVS, IPS, orthogonality, Banach space, Hilbert Space, subspace, basis, dimension, adjoint, linear operators, projections, etc., where appropriate.

**Final projects will be evaluated based on the level of understanding, the originality, connection to and application of ECE 513 class material, and amount of the presented work.**

**Project Proposal**

Your first step in working toward a project is to submit one page proposal containing the following:

1. Statement of the research problem, listing the papers you selected for your project. Typically this will be a primary paper + a background paper (or even book) as a reference.
2. Scope of the project -- describe what you plan to do in your project, and how you will satisfy the requirements listed under “Project Contents” above.
3. Connection, if any, between the ECE 513 project and your current research – as described above.

**Project Deadlines**

- **One page proposal** (3% grade): April 21
- **Oral presentation** (7% grade): May 7
- **Project report** (20% grade): May 14.