

SUMMER 2022 – SC EPSCOR /INBRE RET PROJECT DESCRIPTION FORM

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Research Subject Area	Mathematical Modeling and Machine Learning

A. Briefly describe overall research program at your laboratory.

I have been working with students for summer research and senior projects in mathematical modeling. Here are the titles of several projects completed in the past:

- (1) Mathematical modeling for the force curve of a soccer ball for analyzing women's soccer injuries.
- (2) Mathematical modeling for the ecosystem in the Yellowstone National Park after white wolves were re-introduced in 1995.
- (3) Mathematical modeling for two factor interest rate for stocks.
- (4) Mathematical modeling for the growth of COVID-19 cases in 2020.
- (5) Mathematical modeling for image processing.
- (6) Mathematical modeling in high school classroom.

For details, please visit the poster presentations for these projects given at:

<https://citadel.instructure.com/courses/13420/pages/scholarship> .

Currently I am working on the following projects:

- (i) Regression and dynamic regression models for the growth of COVID-19 cases.
- (ii) Polynomial regression for 2 dimensional and 3 dimensional parametric curves.
- (iii) Mathematical modeling with machine learning methods.

B. Briefly describe specific project(s) for your teacher:

Mathematical models are of great importance in natural sciences and engineering. Often a mathematical model: discrete or continuous, linear or nonlinear, explicit or implicit, static or dynamical, deterministic or probabilistic, is chosen to best fit the given data (supervised and unsupervised) from a real-world application. For this RET project, we will study how to develop mathematical models using regression methods. We will go through the following topics in detail: data collecting, regression methods, mathematical modeling using regression methods, statistics methods for analyzing and evaluating a developed model, and improving a model with given or additional data. Each participant will choose one real-world application as his/her project. I look forward to working you!

C. Will any other people (post docs, grad students, undergraduate students, colleagues, etc.) be involved directly with your teacher?

None.

D. Will you require any advanced reading/preparation for the teacher? If yes, please briefly describe.

No prerequisite is required for this project. Some short reading materials on background information about regression algorithms for mathematical modeling and real-world applications will be recommended. A document file will be created for each participant in Google Docs at <https://docs.google.com>. Weblinks to all reading materials will be posted in this document. We will go over the reading materials through working on the project. All discussion, work and results for the project will be recorded in this document.