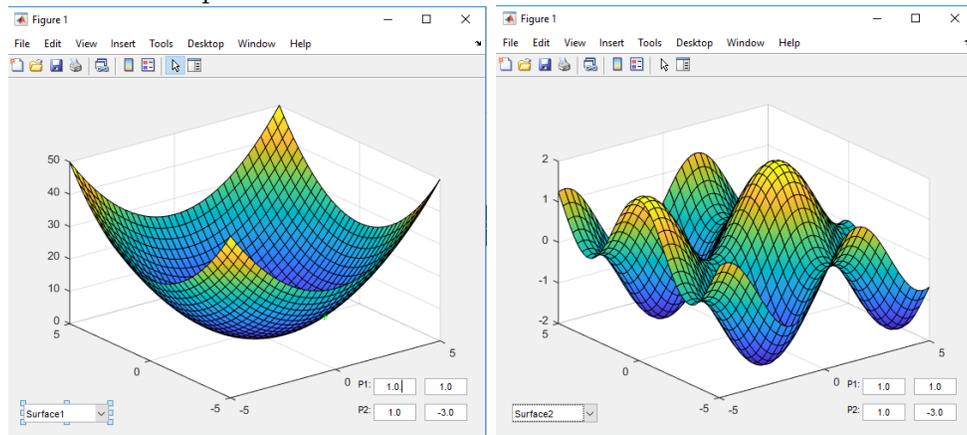


Project Update 1

Bethany Witemeyer
Geodesics on Tensor Product Surfaces

Summary of Work

At this point, all I have worked on is the user interface for my project. I am writing my code in MATLAB and the user will be able to choose which surface to use for calculating the geodesics. Additionally, the user will be able to input the starting and ending points for the geodesics. Currently, the user interface will allow the user to switch between two predefined surfaces, as shown in the images below (the toggle is in the bottom lefthand corner). I have not yet added support for tensor product surfaces to my code, and the surfaces used are placeholder functions.



As seen in the images, the user interface also has places for the user to update the values of the starting and ending point (bottom righthand corner). While new values can be entered into these text fields, I am still working out the bugs in getting them to correctly update the location of the points on the plot.

Analysis of Work

The goals for this update listed on my project proposal were as follows:

1. Determine how to represent the tensor product surface and paths in the code.
2. Be able to visualize a tensor product surface and paths along that surface.
3. Determine level of user interactivity desired in project code.

Goal 1. has been partially completed. I have decided to use MATLAB to write the code, which means that I will be using MATLAB structures to represent the surfaces and paths. However, I am not sure yet exactly what that will look like. Goal 2. has not been met. I have a very small amount of progress for this goal by visualizing placeholder functions. However, I cannot yet visualize tensor product surfaces or paths between my starting and ending points. Goal 3. is nearly completed. I have determined that I would like the user to be able to pick the surface as well as the starting and ending points for the geodesic calculations. I have almost finished implementing those levels of user interactivity.

For each of the goals listed above, the reason they have not been met (or have only partially been met) is that I did not work on this project very much since the proposal was due. This was due to several factors, including having other assignments and research to work on, poor time management, and just forgetting that the project was something I needed to work on.

Plan for Completion

My goals for the next update were originally

- Define objective function(s) for the minimization problem.
- Be able to run the minimization to get a shortest discrete path on the tensor product surface.

My final goals were originally

- Adjust the output from the minimization if needed to generate a curve with points evenly spaced along the arc length.
- Be able to visualize the intermediate steps of the minimization process.
- Determine the minimization settings which give the best results.

I am planning to leave these goals the same, adding the additional goal for the next update of finishing work planned for this update. To get caught up, I plan to allocate more time in my schedule toward working on this project.

Finally, I'm adding another stretch goal to my list. Originally, my stretch goals were

- Utilize machine learning to speed up the calculation of the approximate geodesics.

- Investigating if any of the various methods for calculating geodesics on discrete surfaces can be used for calculating geodesics on continuous surfaces.

Because there are several equivalent definitions of a geodesic on a continuous surface, I'm curious as to if one of them produces a faster and/or better solution than the others. So, I am adding a stretch goal of

- Use different definitions of a geodesic to compute the objective function.