Math178 SU19
Homework 6
Due: Fri, June 21, 2019

Feel free to work with other students, but make sure you write up the homework and code on your own (no copying homework *or* code; no pair programming). Feel free to ask students or instructors for help debugging code or whatever else, though.

Note: You need to create a Github account for submission of the coding part of the homework. Please create a repository on Github to hold all your code and include your Github account username as part of the answer to the coding problems.

1 (**1st fundamental form.**) Compute the first fundamental form of a sphere at a point of the coordinate neighborhood given by the parametrization:

$$\mathbf{x}(\theta, \psi) = (\sin\theta\cos\psi, \sin\theta\sin\psi, \cos\theta).$$

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2 (**Area.**) Compute the area of the torus with the coordinate neighborhood corresponding to the parametrization:

$$\mathbf{x}(u,v) = ((a + r\cos u)\cos v, (a + r\cos u)\sin v, r\sin u),\ 0 < u < 2\pi, 0 < v < 2\pi,$$

which covers the torus, except for a meridian and a parallel.

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3 (**Coding.**) Please use the 6 features (accelerometer: x, y, z and gyroscope: x, y, z) of H-MOG dataset to do the following:

(a) Pick some users. For each user pick 3 out of the 6 features. (Or if you have time, you can try all the 20 combinations.)

(b) For each data point of the 3 features v_1, v_2, v_3, normalize the vector $\vec{v} = [v_1, v_2, v_3]$ by:

$$\hat{v} = \frac{\vec{v}}{||\vec{v}||_2}.$$

(c) Plot the normalized data points (vectors) on a sphere.

Note that a starter file is included under "resource" tab. Please feel free to ask TA if you have any question.

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