ME395 Homework 2

Rao Fu

The purpose is to decide the amount of setting parameters of 3D printers, including layer height (mm), wall thickness (mm), infill density (%), infill pattern (), nozzle temperature (Cº), bed temperature (Cº), print speed (mm/s), material () and fan speed (%), influencing its roughness (µm), tensile strength (MPa) and elongation (%) as measured output parameters. This work is based on the Ultimaker S5 3-D printer settings and filaments. Material and strength tests were carried out on a Sincotec GMBH tester capable of pulling 20 kN. (This dataset comes from research by TR/Selcuk University Mechanical Engineering department.)

Six steps using MDS are shown below:

1. Data collection and generation:

layer_height	wall_thickness	infill_density	infill_pattern	nozzle_temperature	bed_temperature	print_speed	material	fan_speed
0.02	8	90	grid	220	60	40	abs	0
0.02	7	90	honeycomb	225	65	40	abs	25
0.02	1	80	grid	230	70	40	abs	50

~ 50 data points from Kaggle.com

2. Mechanistic feature extraction:

   9 setting parameters: layer height (mm), wall thickness (mm), infill density (%), infill pattern (), nozzle temperature (Cº), bed temperature (Cº), print speed (mm/s), material () and fan speed (%). 3 Output parameters: roughness (µm), tensile strength (MPa) and elongation (%)

3. Dimension reduction:

   Dimensions are reduced by mechanistically selecting key parameters to datasets.

4. Reduce order model:

   The order of the model is reduced via linear assumption.

5. Mechanistic learning through regression:

   Use regression to determine model parameters.

6. System and design:

   Prediction of 3D printer’s performance and relations between the input parameters.