Computational Fabrication

CS 491 and 591 Professor: Leah Buechley

Final Projects and Final Project Presentations

Our final exam time: 7:30am on 12/12

Proposal: presentations last day of class 8:30am - 11:00am, Thursday 12/7

Final Project Update due Tuesday after Thanksgiving

https://handandmachine.org/classes/computational_fabrication/2023/11/16/final-project-update-5/

questions?

Camila Tiling Assignment

Generative Machine Learning Tools cont.

Chat GPT & text-based generators

Text generator directly to text file?

- STL file
- gcode file

Let's try!

Text generator directly to text file?



Tool that supports training a GAN Open <u>https://runwayml.com/</u>



Ê

Train a Portrait Generator

Create your own custom Portrait Generator for Text to Image.



Train an Animal Generator

Create your own custom Animal Generator for Text to Image.



Ê

Train a Custom Generator

≞

Create your own generator to use with Text to Image.

Example training a custom model

One Example Workflow

- Use one computational design method to generate 100s-1000s of examples
 ie: Processing program generates images of trees
- Use these examples to train ML model
 Upload images to Runway and train
 Note: takes several hours
- Runway starting model generates images based on Biodiversity Library drawings of birds:

https://www.flickr.com/photos/biodivlibrary/sets/

Training Images













Starting Model Training Images



After 500 Training Iterations









After 1000 Training Iterations



After 1500 Training Iterations



Videos, Exploring Search Space



After 500 Training Iterations

After 1000 Training Iterations

Videos, Exploring Search Space





After 1000 Training Iterations

After 1500 Training Iterations

Impact of AI on Artists



Artist Work

Reading Donald Trump's Twitter feed



Reading Crooked Hillary's Twitter feed





O Sarah Andersen

Manipulation & Unauthorized Use on Social Media



Al Generated "in the style of"

https://www.nytimes.com/2022/12/31/opinion/sarah-andersen-how-algorithim-took-my-work.html

questions?

Fusion 360

AutoDesk: Fusion 360

- Modeling for engineering
- Many Features not in Rhino:
 - Geometrical Constraints
 - Timeline
 - Materials
 - Electronics
 - Simulations:
 - Stress and strain on different materials
 - Forces
 - Fluid Flow

Designing two stools



Dimensions: Height: 18" (45cm)

Seat Diameter: 14" (35cm)

Bottom Diameter: variable

using ML tools built into Fusion 360

Stool 1 Using Topology Optimization



Dimensions: Height: 18" (45cm) Seat Diameter: 14" (35cm) Bottom Diameter: variable

Topology Optimization

- Fusion optimizes for structural strength (stiffness) and use of material
- Given an area the design can occupy along with a set of constraints, it will use ML to carve material away to reveal an optimal design
- Produces a single optimal design.
- Provide: Large mass to carve away, contact points for feet and seat.

Open up Fusion 360

Change Preferences: Don't save history



Change Preferences: Don't save history

Preference

General	Preferences controllin	ng general Design behavior
API Design Manufacture	Active component visibility	
Color	Design History	Do not capture Design History (Direct Modeling)
Drill	Animate joint preview	
Reset Grid	Allow 3D sketching of lines and splines	
Directory	Auto project edges on reference	
Render	Auto look at sketch	
Simulation and Generative Desi	Edit dimension when created	
Tokens & Cloud Credits	Show ghosted result body	
Material	Auto project geometry on active sketch plane	
Display	Auto hide sketch on feature creation	
RDP Optimization	Scale entire sketch at first dimension	
Network	Allow creation of Assembly Context during an Edit in Place session	
Data Collection and Use Unit and Value Display	Enable Arrange and Simplify tools	
Simulation and Generative Desi	Enable Arrange and Simplify tools	
Default Units		
Design		
Manufacture	Preferences that control inserting a mesh	
Simulation and Generative Desi	Triangulate mesh polygons	
Preview Features	······································	
	Default Shading	Smooth shaded (Organic/smooth shapes; increased performance)

Document Basics



DESIGN -	SOLID SURFACE MESH FORM
 ← BROWSER ▲ ● □ ▲ ◆ ■ ■	Create Sketch Enters Sketch mode, where you create geometric profiles that define the foundation of a design. Then use commands like Extrude, Revolve, and Loft to create 3D bodies from sketches. Select a construction plane, then create lines, arcs, or points to create sketch and construction geometry.Constrain sketches with dimensions and constraints.Select Finish Sketch to exit Sketch mode.
D 🕲 🖬	Press #/ for more help.

2D Drawing = Create Sketch





Drawing Basics: Constraints, Measurements

Sketch cylinder and feet

Dimensions: Height: 18" (45cm) Seat Diameter: 14" (35cm) Bottom Diameter: variable

Extrude them into solids



Topology Optimization Setup

questions?

Stool 2 Using "Generative Design"



Dimensions: Height: 18" (45cm) Seat Diameter: 14" (35cm) Bottom Diameter: variable

Generative Design

- Fusion connects different objects to create a set of strong designs that meet a set of defined constraints
- Given starting shapes, it will use ML to connect these shapes in ways that give rise to different functional designs
- Provide obstacles to define regions the design should not occupy.
- Produces several designs
- Provide: Seat and feet to be connected + obstacles

Sketch cylinder and feet

Dimensions: Height: 18" (45cm) Seat Diameter: 14" (35cm) Bottom Diameter: variable

Move top to correct location

Extrude them into solids

Generative Design Setup

questions?

Check Back on your Topology Optimization

Check Back on your Topology Optimization





Check Back on your Topology Optimization





Check Back on your Generative Design

4 legged stool with no obstacles



3 legged stool with obstacle



Thank you!

CS 491 and 591 Professor: Leah Buechley