Smart 3D Printing Surveillance: Detecting Failures with Computer Vision and Machine Learning

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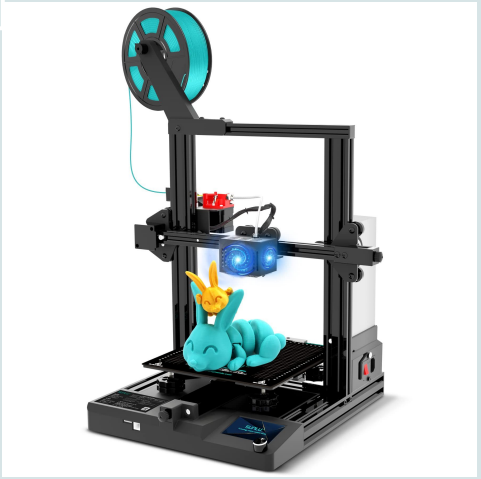
What is 3D printing?

Types of Printers

FDM

Filament-based



SLA

Resin liquid hardened by UV light

SLM

Powder-based

Parts of a 3D Printer

01

Motion controllers

Moves on the XYZ axis

02

Print bed

Heated vs. non-heated platform

03

Extruder

Unloads the filament

04

Frame

Structure for stability

05

Connectivity

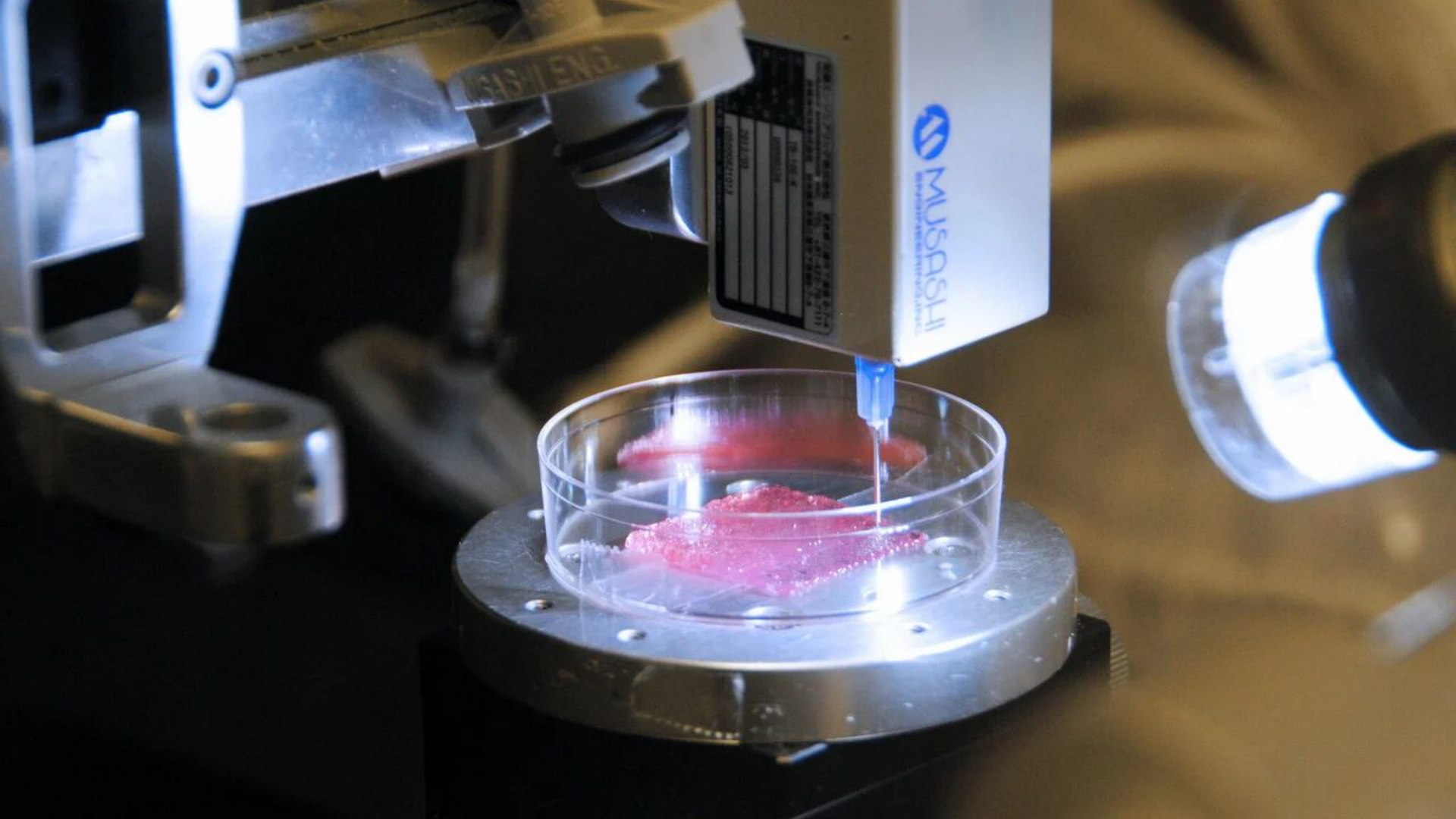
Power for the printer

06

Filament

Material used to print

Why should you care?


MUSASHI

CRANE WASP
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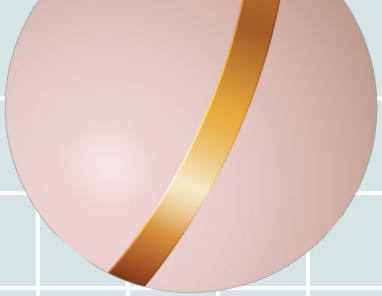
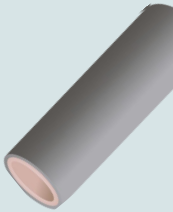
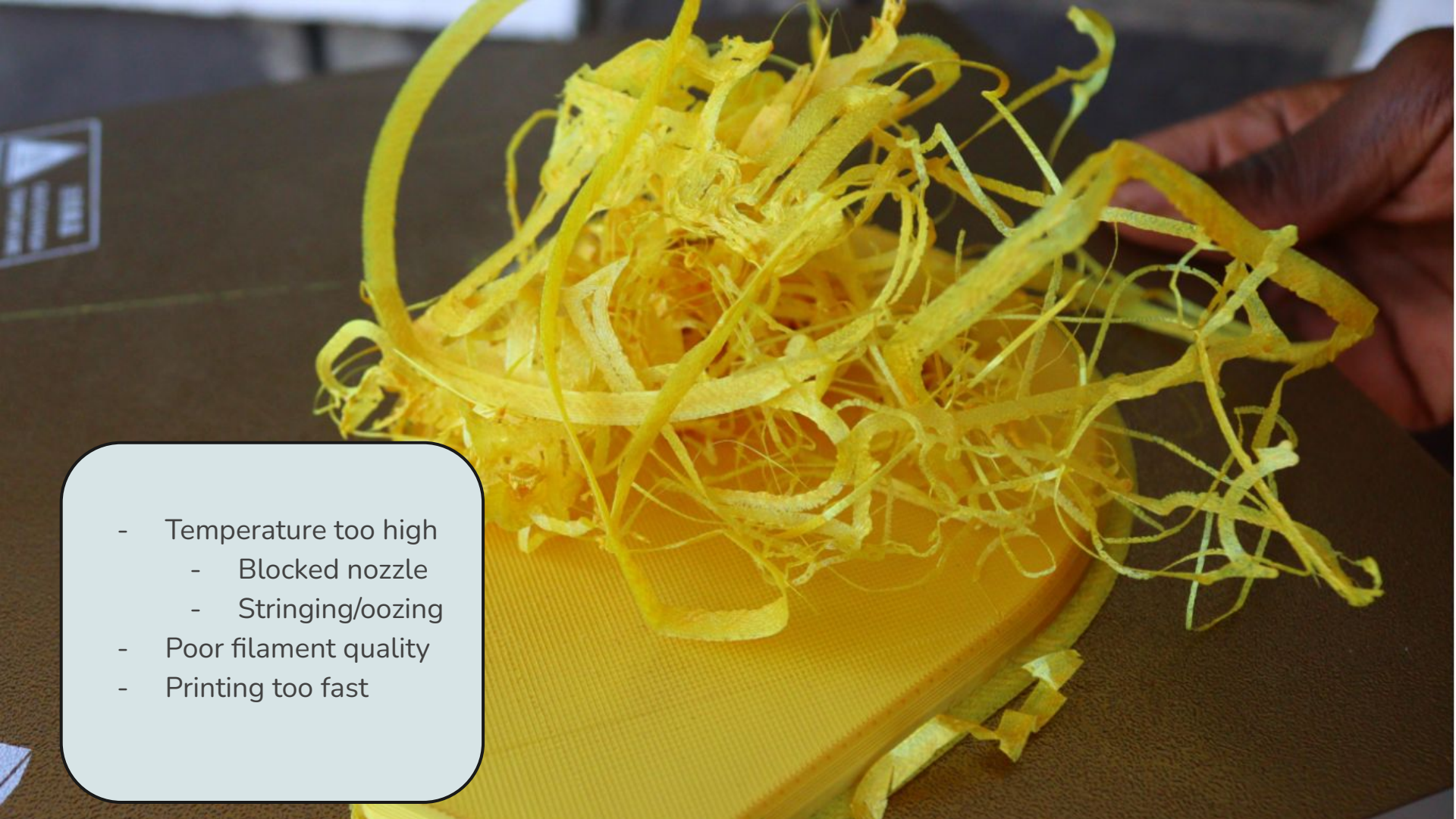


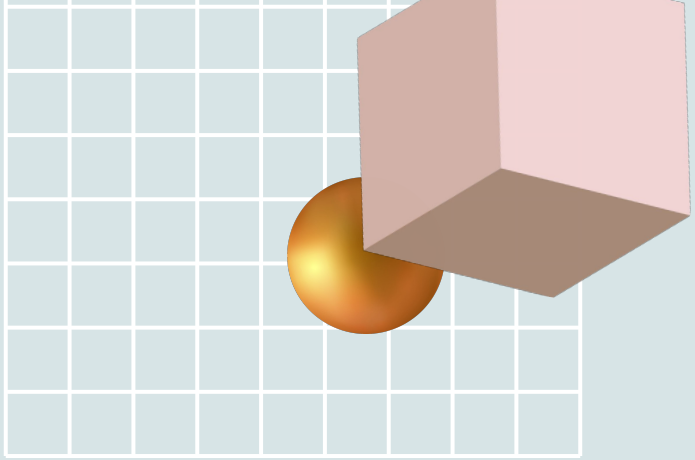
It can fail.





- Temperature too high
  - Blocked nozzle
  - Stringing/oozing
- Poor filament quality
- Printing too fast

Previous Works



Automated Process Monitoring in 3D Printing Using Supervised Machine Learning (Delli et al.)

Detects the quality of 3D printed parts (more specific)

"A study of failure detection and prediction for FDM 3D printers" (J. Cao et al.)

- Proposes real-time monitoring

My Solution

Create an AI model

Design an app

Test for results

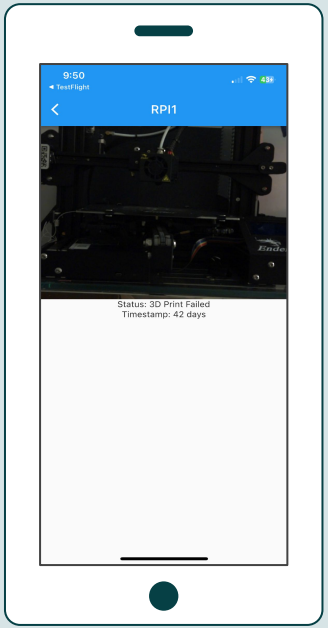
DATABASE

1. Photo
2. Status
3. Timestamp

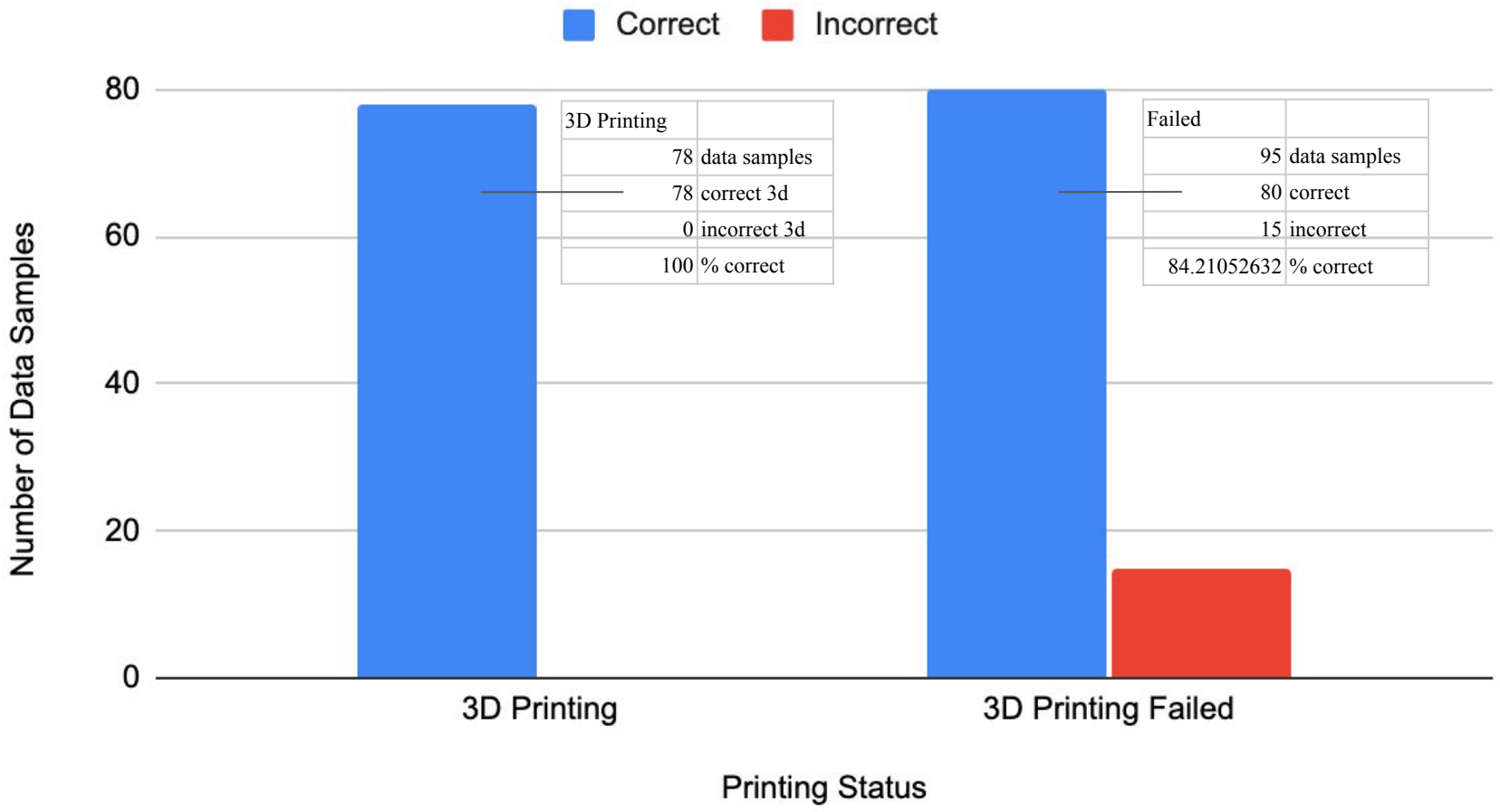
CAMERA

AI

RPI

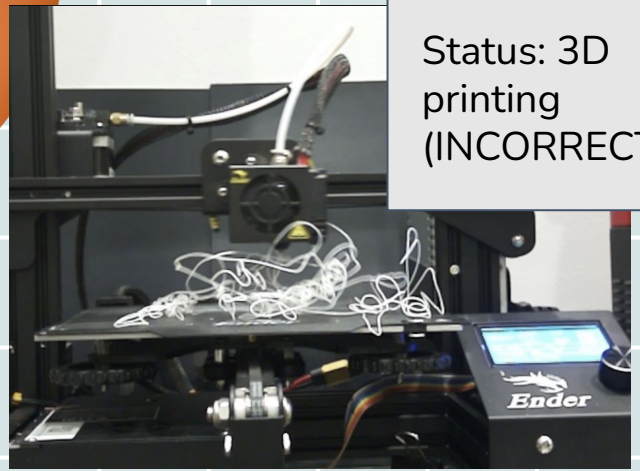


3D Printing Samples

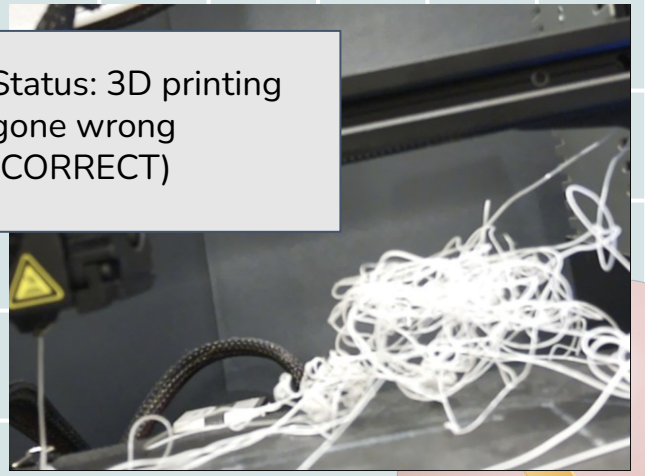


91.3% correct

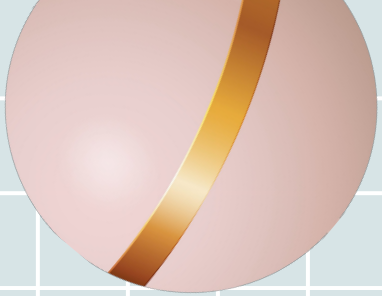
3D printing: 78-0; 3D printing failed: 80-15-18

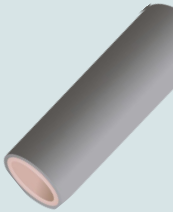


Status: 3D printing (INCORRECT)



Status: 3D printing gone wrong (CORRECT)

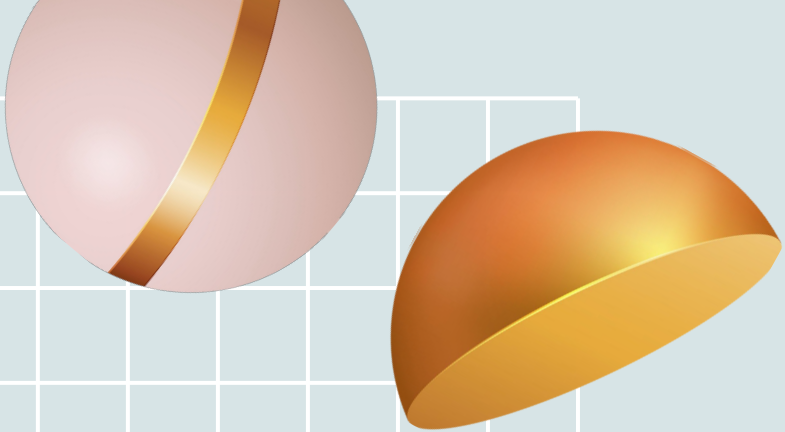




Challenges

Future Work

- Explore innovative applications (e.g. crane games)
- More experiments
    - Training my model with more pictures
    - Running more trials with different types of backgrounds, colors, printers
    - Types of failures (e.g. power outage)
- Improving aesthetic of the app



Thank you!