IBM-RA INSPECTION SIMULATION TESTBED

INTERNSHIP PROJECT FOR MY SUMMER INTERNSHIP.

15TH JULY TO 15TH SEPTEMBER 2022

INTRODUCTION

WHO AM I?

NAME: SHARON MURUGI

SCHOOL: CATHOLIC UNIVERSITY OF EASTERN AFRICA

COURSE: BSC IN COMPUTER SCIENCE

PASSION: MACHINE LEARNING AND ANIMATION

PRESENTATION

LET'S GET TO IT...

INTRO TO AI AND ML

WHAT DO WE KNOW?

- AI IS HOW MACHINES MIMIC HUMAN INTELLIGENCE.
- ML IS HOW MACHINES ARE ABLE TO DEVELOP THIS INTELLIGENCE.

MY MOTIVATION

- HOW I KNEW ABOUT COMPUTER SCIENCE

COMMON ML TASKS

- CLASSIFICATION
- REGRESSION
- CLUSTERING

ABOUT

CREATE SIMULATED ENVIRONMENTS FOR MANUFACTURING INDUSTRY

The aim of this project is to create an open-source and easy to use/customise test bed that can be used for visual inspection where we can get to detect objects in the environment, classify those objects as well as detect defects on them.

Why visual inspection? Tt is a very common task across industries and it gives me a chance to learn about multiple types of ML algorithms

The project is a testbed for such use cases.

IDENTIFY

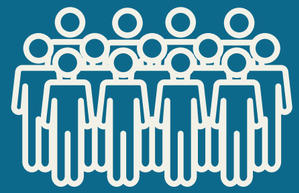
REAL WORLD APPLICATION

MANUFACTURING INDUSTRY

The images could be used at the initial stages of product design and finding out the production process

3D ANIMATORS

This would make good use to 3D animators, to create generative art at a less consumamble time.

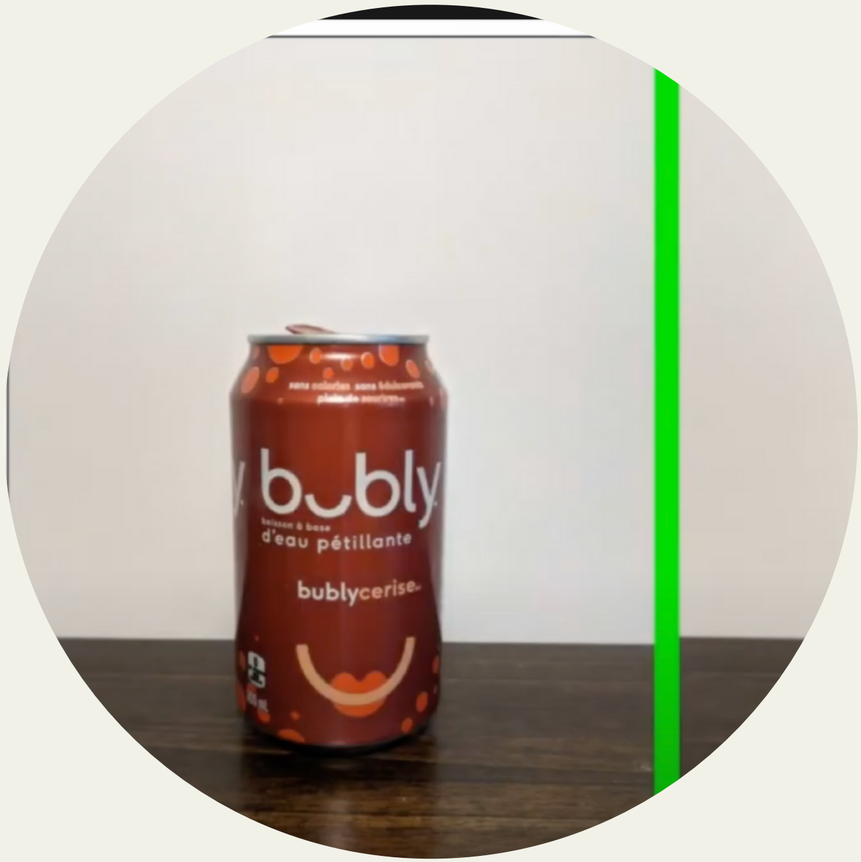


SEARCH ENGINE IMAGES

The model can be used to generate images that can be used by search engines during an image search.

RELATED WORK

WHAT IF



SBX ROBOTICS: DEFECT DETECTION DEMO.

RELATED WORK

WHAT IF

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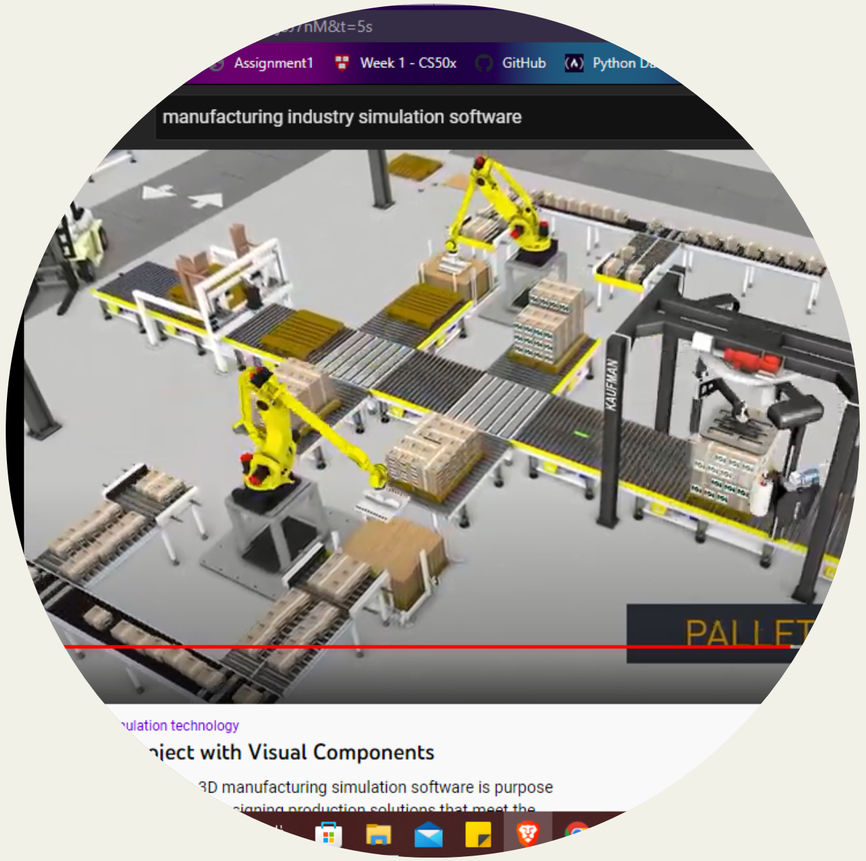
RELATED WORK

WHAT IF



- DO MANUFACTURING SIMULATION
- INTERACTIVE VR
- SIMPLE ROBOTICS
- EASY OF USE THROUGH DRAG AND DROP
- USES SIEMENS PROCESS SIMULATE.
- NOT OPEN SOURCED

INSPECTION SIMULATION: WHAT'S NEW?

- ## GENERATE IMAGES USING A GAN

  This is to make the software available to all users and not developers and designers only.

- ## OBJECT DETECTION

  We want our software to detect the generated images in the 3D environment

- ## CLASSIFICATION

  A classifier will be able to tell us what kind of object has been generated

- ## DEFECT DETECTION

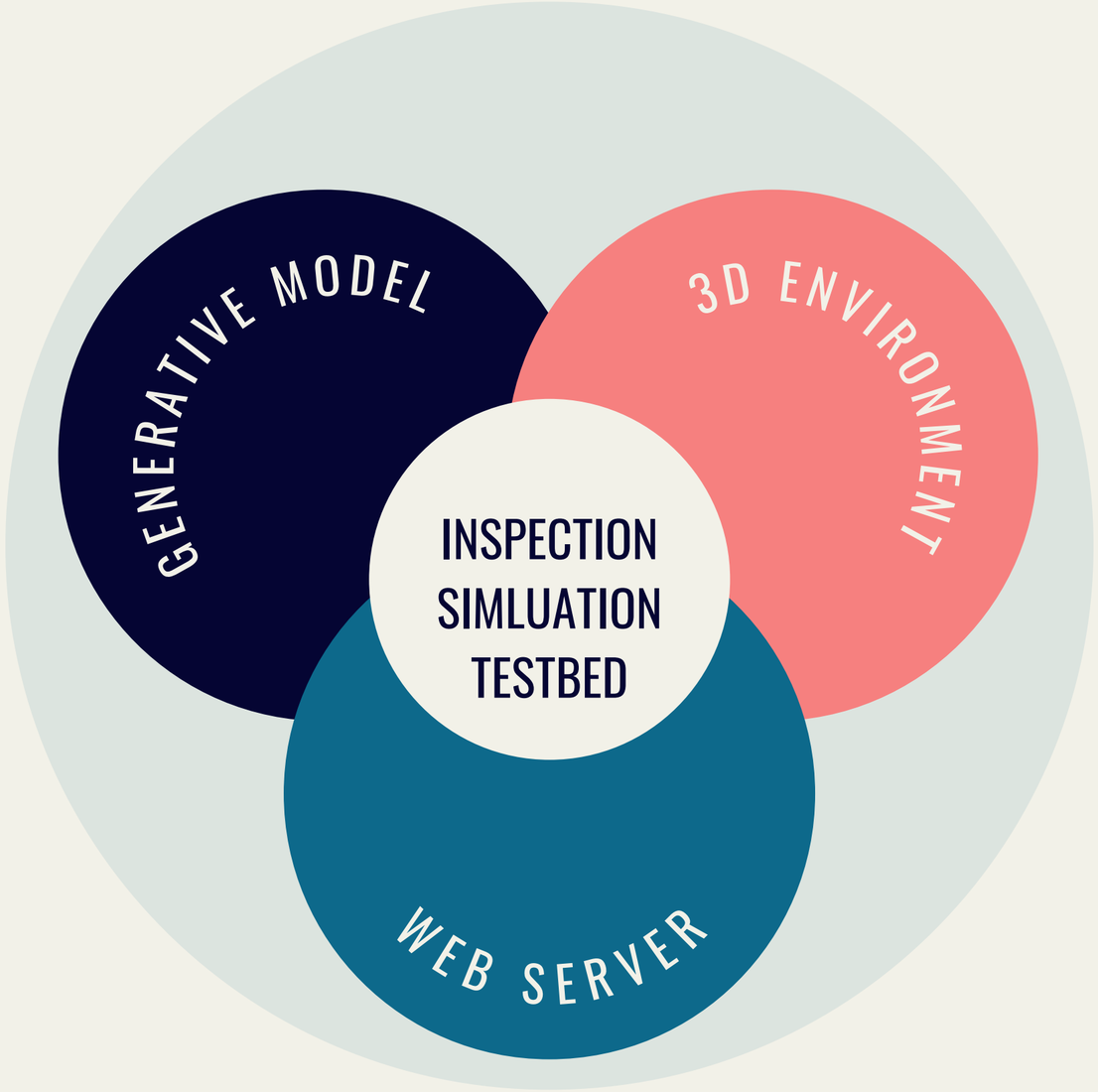
  The model will be trained on normal and defected images that the classifier can easily detect them

- ## INTERACTIVE ENVIRONMENT

  The environment will enable users to interact with the generated product image, i.e zoom in, zoom out, circle around it.

- ## OPEN SOURCE

  To allow users to have more control, train and correct errors with the model.



IDENTIFY

TOOLS USED

The following are tools I used to make a testbed for the inspection simulation:

GENERATIVE MODELS

The recommended model was the Generative Adversarial Network.

3D ENVIRONMENT

A suitble 3D environment like Blender, Unity or Three.js

WEB SERVER

We used Flask to host the images and call them into the threejs environment.

METHODOLOGY

THE HOW

LEARNING RESOURCES

- I learnt about machine learning for Freecodecamp.
- GANs from Google Developers Foundational Course on ML.
- YouTube
- IBM Your Learning

CHARACTER DESIGN BACKGROUND

- My interest in animation design,

gave me knowledge of tools like Blender.

VISUAL REPRESENTATION

IBMRA CUEA Inspection Simulation Testbed

Piloting with analog clocks

3D env
With a mobile camera stream
With programmatic control of assets

\+

programmatically
create assets in
controlled settings

\+

Classifier to detect/recognize assets
based on camera data

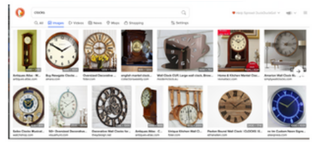
3JS
Unity
Blender/Morse
TDW

Static images
Image factory
[Ideally]GAN

Yolov5
Manually generated

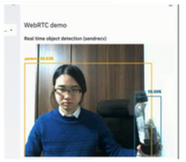
https://blog.cogapp.com/how-to-create-a-virtual-3d-gallery-using-iiif-and-three-js-ad6766e45d3f

https://duckduckgo.com/?q=clock&t=osx&iax=images&ia=images



Approvals pending from Data@IBM

https://github.com/whitphx/streamlit-webrtc



THE TEST

TIME TO SEE

The following is what I have managed to do during my internship period.

INSPECTION SIMULATION

CHALLENGES

- ## THE ENVIRONMENT

  The initial starting point was with Blender, except it didn't have tools to import the generated images into its environment

- ## DATA APPROVALS

  It took a while to get the clocks dataset approved therefore less time to work on the GANs.

- ## KNOWLEDGE GAP

  I had to learn javascript while using the threejs as an alternative to Blender.

- ## DETECTION AND CLASSIFICATION

  These tools require mature tools, and I was not able to get the classifier to detect objects in the environment.

- ## TIME LIMIT

  At the expense of time I had to use foundational models like YOLO and use Python computer vision tools.

WHAT NEXT?

FUTURE WORK

- BLENDER AND NEURAL NETWORKS
- CREATE A CLASSIFIER THAT CAN DETECT DEFECT ON IMAGES
- EXPERIMENT WITH OTHER GENRATIVE MODELS
- TESTING MY CODE DURING MOBILITY
- THE INSPECTION SIMULATION IS NOT LIMITED TO MANUFACTURING INDUSTRY

ACKNOWLEDGEMENT AND SPECIAL THANKS

IBM - RA

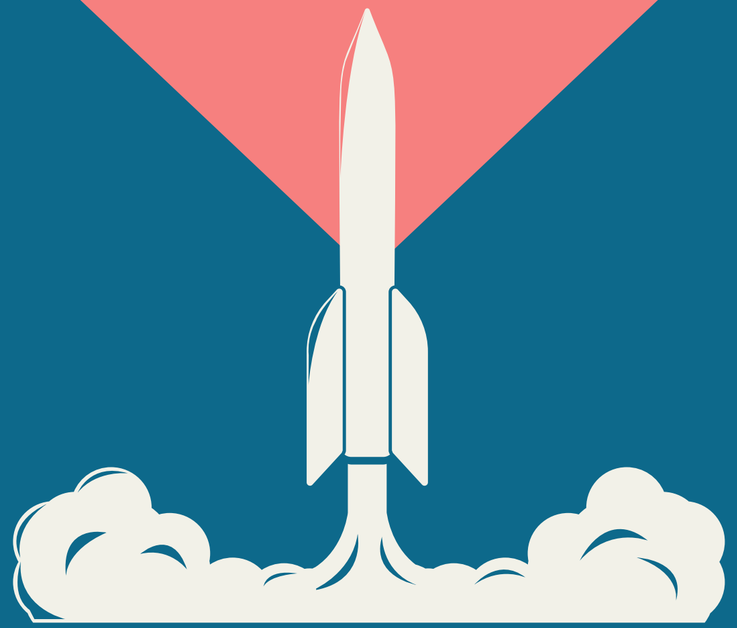
THE INTERNSHIP

MENTORS

Sekou Remy | Catherine Wanjiru

FELLOW INTERNS

Motivation to do Masters, more research and delve into ML more.



THANK YOU