

Proposal to Integrate Computer Vision in Sofa Manufacturing

Team Members: Osemudia Ogedengbe, Yahmeania Powell

The Problem

- The sofas are often in low quality and are of inconsistent quality between each other.
- This is significant as the company who manufactures sofas prioritizes them to be of high quality to increase their appeal.
- Plus, in the case that the company will make other furniture with fabric, it needs to improve how it manufactures the already existing sofas.

Our Solution

- Present frame of the Sofa → Camera → Use computer vision to inspect defects in the frame of the sofa → Generates report → If successful, present the fabric of the sofa → Camera → Use computer vision to inspect defects in the fabric of the sofa → Generates report → If successful, finish the creation of the sofa.
- This process will tackle the structure and presentation of the sofa to improve its quality.

Technical Approach

- This plan will utilize automated visual inspections. As such, a combination of techniques are necessary to properly perform the inspection. Techniques such as image processing, object detection, classification, and defect detection, the process of identifying imperfections, often using an automated approach.
- Models like ResNet or CNNs are good models to use due to their high-accuracy and precision in detecting defects. However, especially for ResNet, they will take more training time will require careful regularization to prevent overfitting.
- TensorFlow and PyTorch are good frameworks for the purposes of detecting defects model.
- Since the model needs to detect defects big and small, it needs to dedicate time to it, which is why models like ResNet and CNN are my preferred models. However, for the framework, popular frameworks like TensorFlow and Pytorch can work just fine.

Dataset Plan

- There will be two groups of data. One for fabric defects, and one for frame defects. The source of the data can be a combination of fabric/frame defects and perfections from a public dataset, like Kaggle, and the images of the defects and perfections from the sofa company's previous sofas.
- The size will generally be around 1000-2000, not too small to limit the model's knowledge on defect detection, but not too big as to take away processing power from the already power-intensive model.
- This data will be used to detect and differentiate perfect frames/fabric, and defective frames/fabric.
- Due to the nature of this training, the data needs to be labelled so that we can quantify how many the model got right and wrong and improve on that. The data also needs to be cleaned to make it easier to track.

System Diagram

- [Acquisition of the image of the sofa frame from the camera] → [Model inference] → [Decision between keeping the frame, or discarding it] → [Under the assumption that the sofa frame is accepted, acquisition of the image of the sofa fabric from the camera] → [Model inference] → [Decision between keeping the fabric or discarding it] → [Under the assumption that the sofa frame is accepted, continue with the sofa production to the finished product]

Success Metrics

Metric Type	Example	Target
Primary Metric	Accuracy	$\geq 90\%$
Secondary Metric	Speed	< 1 s per image

Week-by-Week Plan

Week	Task	Milestone
10 (Oct 30)	Get dataset, set up environment	Dataset ready
11 (Nov 6)	Train or fine-tune model	Model working
12 (Nov 13)	Test and improve	Good accuracy
13 (Nov 20)	Create demo / video	Demo ready
14 (Nov 27)	Final testing / documentation	Everything done
15 (Dec 4)	Present project	Presentation day

Challenges & Backup Plans

- Not enough data → Use Roboflow dataset.
- Low accuracy → Add augmentation or bigger model
- Low speed → Use faster model like YOLOv8

Resources Needed

Resource	Options / Notes
Compute	Colab, Kaggle
Frameworks	PyTorch, TensorFlow
Models	ResNet, CNN, YOLOv8
Estimated Cost	\$0