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CONTACTLESS CARTON COUNTING IN WAREHOUSES (MID-TERM)

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BACKGROUND

- Carton counting is a task mostly done manually in warehouses by labor.
- Manually doing this task is expensive because of:
  - **Labor costs**
  - **Time taken** to count all cartons on pallets, and
  - How **error-prone** manual counting can be
- Amazon.com delivered approximately **3.5 billion packages** in **2019**. Expected to deliver approximately **6.5 billion packages** by **2022**.
- With an error of just **1%** (industry rate is 2-5%), around **35 million packages** were not delivered properly on time.

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INTENT

DESIGN A SYSTEM FOR CONTACTLESS CARTON COUNTING IN WAREHOUSES THROUGH COMPUTER VISION AND MACHINE LEARNING

SOLUTION (MVP)

- A viable solution that can detect cartons on pallets and count them accurately, will involve both **computer vision (CV)** and **machine learning (ML)**.
- The solution will work in the following manner:
  1. Take multiple pictures from different angles of the pallet with cartons.
  2. Do carton detection on the images and return an accurate total for the number of cartons on the pallet being counted.

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APPROACHE-1: What we wanted to achieve?

- Basic carton detection on a simple image of **cartons on a pallet**, where the image is only a front view image to exclude the complexity of angles.
  - **Input:** Image
  - **Output:** Carton detection & Number of cartons on the pallet
- The image on the right is our **test image**.

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APPROACHE-1: Result

Number of Cartons: 20

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APPROACHE-1: Algorithm

Step 1:
Bitwise Invert

Step 2:
Grayscale

Step 3:
Blur

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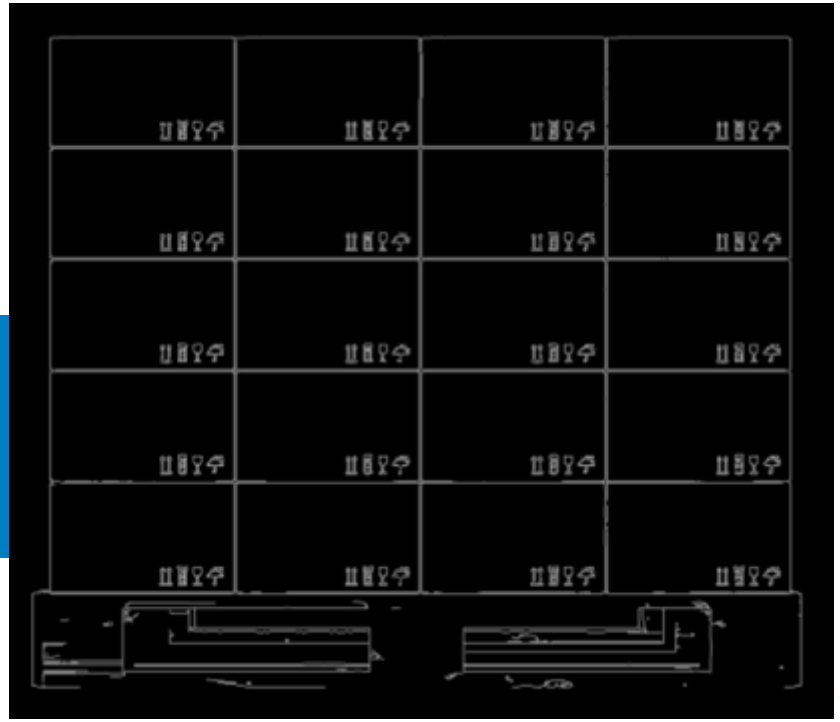
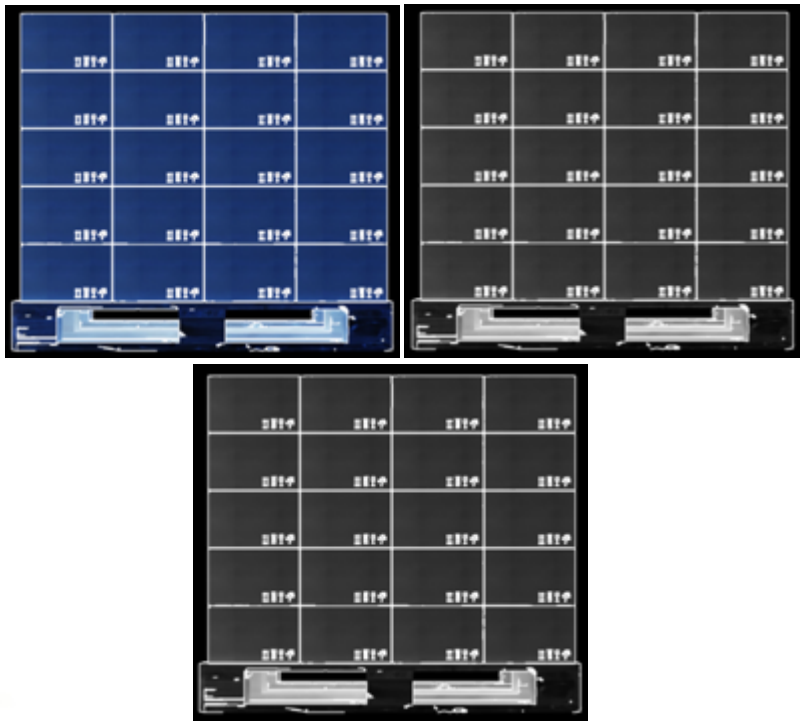
APPROACHE-1: Algorithm (continued...)



Step 4:
Edge Analysis

Step 5:
Overlaying Edges



Step 6:
Repeat Steps 1-4

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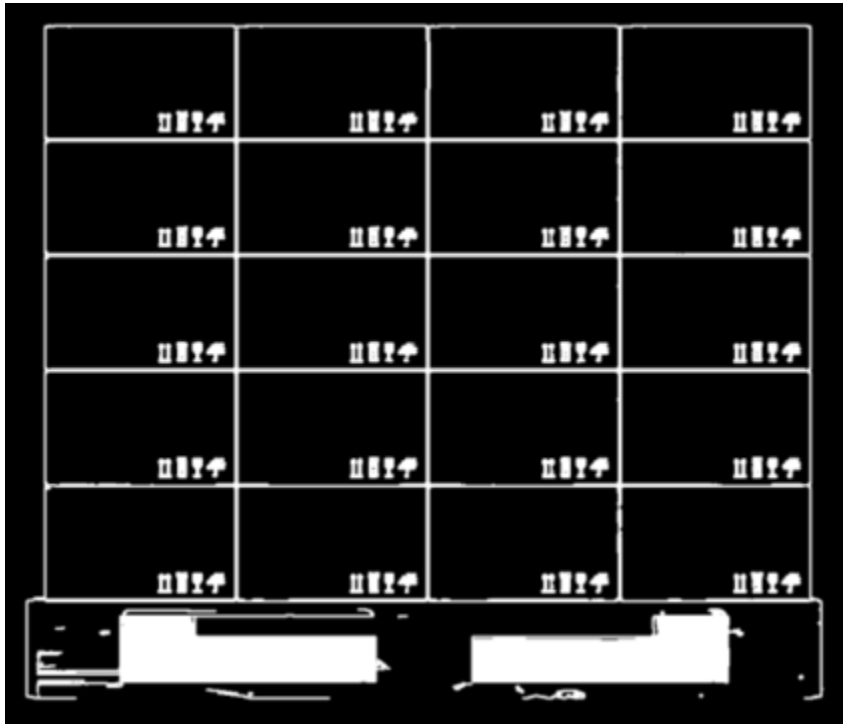
APPROACHE-1: Algorithm (continued...)



Step 7:
Threshold Analysis

Step 8:
Shape Detection
(Carton Detection)

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NEXT STEPS

- **Step-2**: The **shape detector** will be re-designed as an ML Classifier, which will be more accurate in terms of determining if a shape is a carton or not.
- **Step-3:** Determining the total number of cartons on a pallet through multiple images of the pallets from different angles.
- **Step-4:** Detect and scan barcodes on cartons to further determine what the carton includes and in what quantity, along with using the carton's dimensions to validate our algorithm's carton counting.

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APPENDIX

- https://www.pexels.com/photo/wooden-pallets-1684989/
- https://techcrunch.com/wp-content/uploads/2018/12/GettyImages-825338394.jpg?w=730&crop=1
- https://axisindustrialsolutions.com.au/media/catalog/product/cache/1/image/9df78eab33525d08d6e5fb8d27136e95/p/a/pallet_cartons.jpg
- https://www.pexels.com/photo/brown-wooden-pallets-635096/
- https://www.pexels.com/photo/photo-of-white-and-brown-cardboard-box-toy-figure-678308/

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HAVE A GOOD DAY! ☺

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