AI based Electriconic Component Identifier

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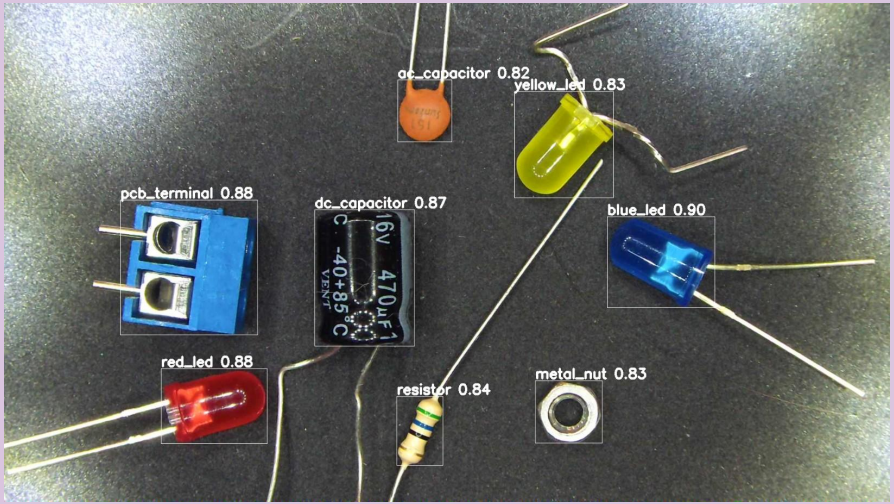
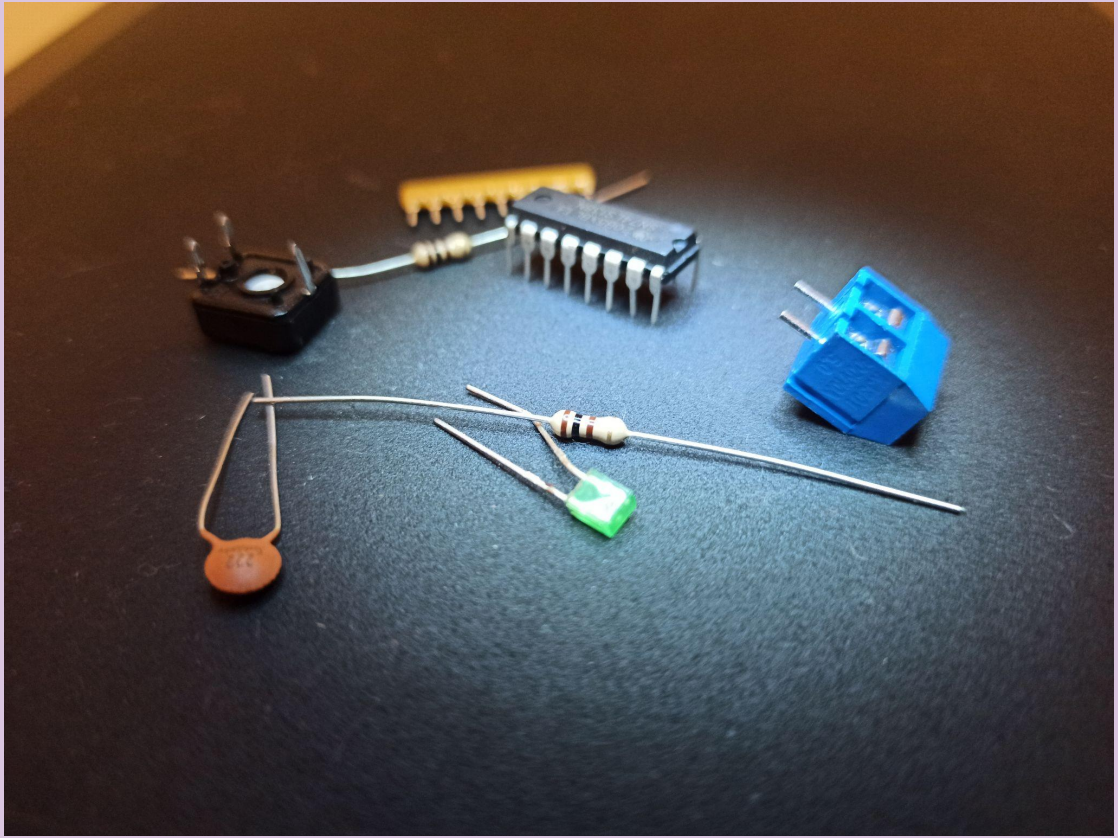
AI based Electronic Component Identification

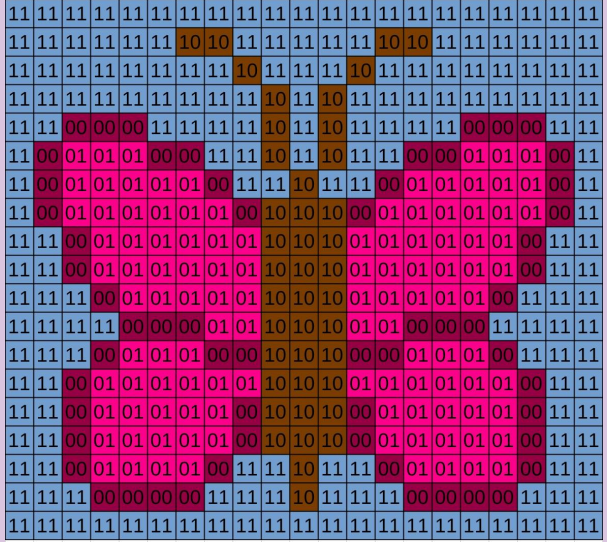
- GUI display
- Identifies:
  - Position (Bounding Box on a live display).
  - Class name.
  - Confidence (Percentage).
  - Quantity.
  - Potential extra information:
    - Resistors - Color code to Ohms.
    - Capacitors - Number code to farad.
    - IC - Pin count, text on the IC if visible.



Object detection

- **Important in**
  - **Security**
    - Notifying concerns
      - People
      - Animals
      - Flora
  - **Production**
    - Discarding defects
      - Damage
  - **Analysis**
    - Quality inspection
      - Scratches
      - Spots
    - Classification
      - Resistor
      - Capacitor
    - Total and class count





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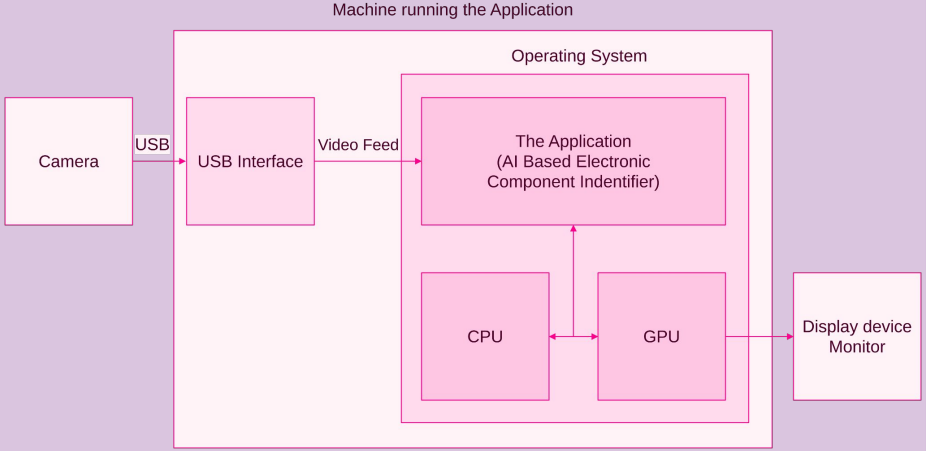
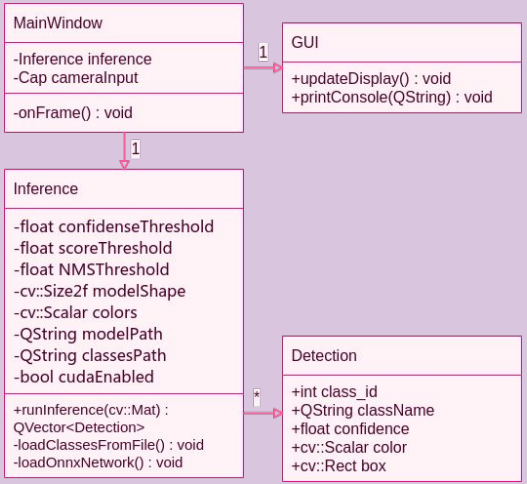
The problem

- Object detection from images:
  - Natural to intelligent creatures.
    - Designed for object detection through evolution.
      - Second nature.
  - Binary data to computers.
    - Has no concept of object, image, or color.
      - Everything is processed the same.

System Block Diagram



Class Diagram

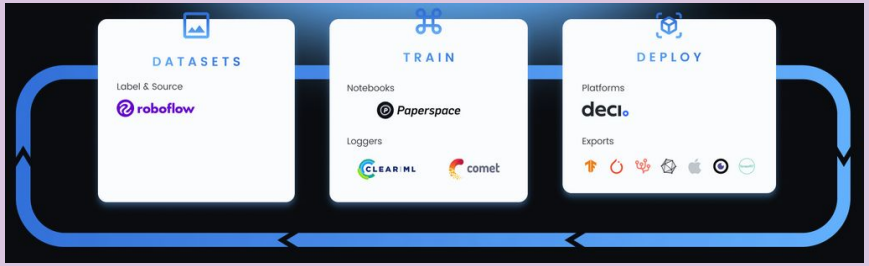


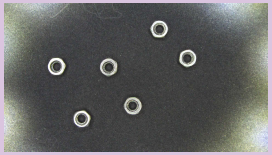
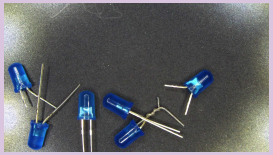
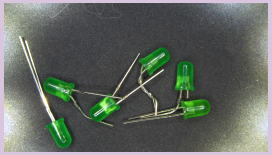
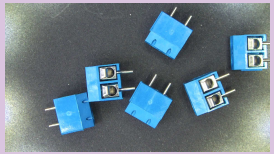
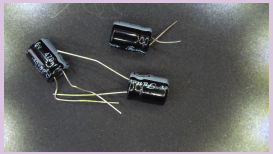
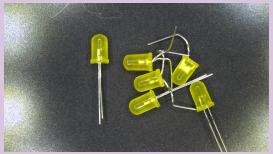
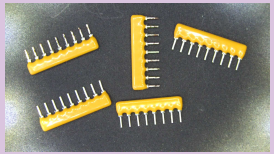
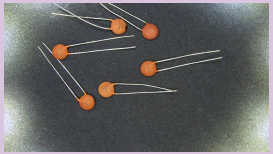
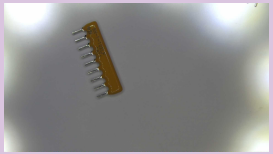
Concept Diagrams

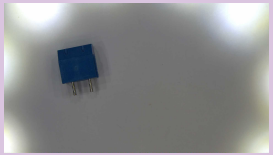
- System Block Diagram
  - Camera is External.
  - Communication through USB.
  - The application utilises both CPU and GPU
- Class Diagram
  - MainWindow is the controller.
  - Inference is responsible for object detection.
  - GUI is the output.

Solution

Inference, Deep Learning

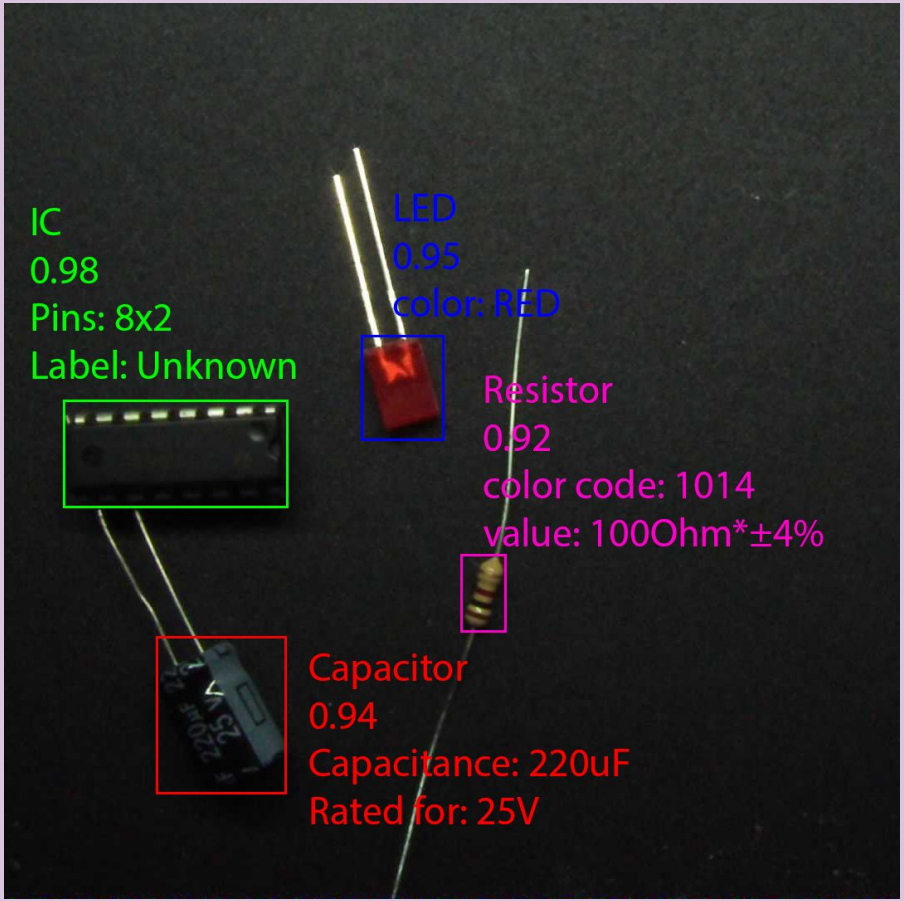





Model Training

- Trained on over 3000 images
  - Taken on the rig.
  - Manually labeled.
- Each picture should have different conditions.



Note: For now, this was achieved through image manipulation.

Post-Processing

Additional processing after Inference has finished running

- Identification of (For those that apply)
  - Labels using Text Recognition
  - Color codes
  - IC
  - Pin count
  - Color (LED)

Discussion

- Inference is capable of extracting an Extremely high level of information.
  - Post-processing is expected to be considerably less accurate.

Conclusion

- Data gathering and training of the model will be the most time and computation intensive process.
- While the project is mostly software-focused, the physical aspects are a crucial key to the overall success of the project.

References

- [1] YoloV5 https://github.com/ultralytics/yolov5, accessed on 6th of November, 2022
- [2] Ultralytics https://ultralytics.com/, accessed on 6th of November, 2022
- [3] COCO dataset https://cocodataset.org/#home, accessed on 7th of November, 2022

The end

Any questions?