Computer Vision with Symbolic Relations

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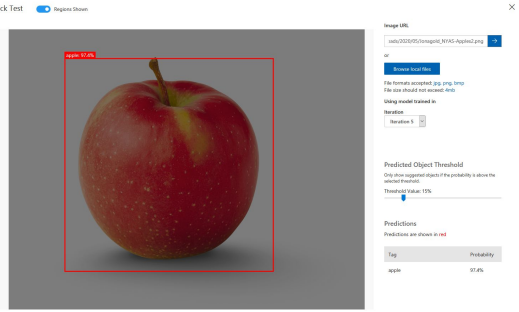
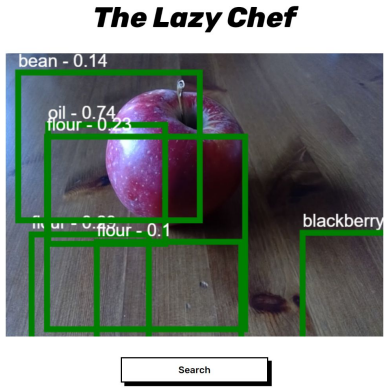
Abstract

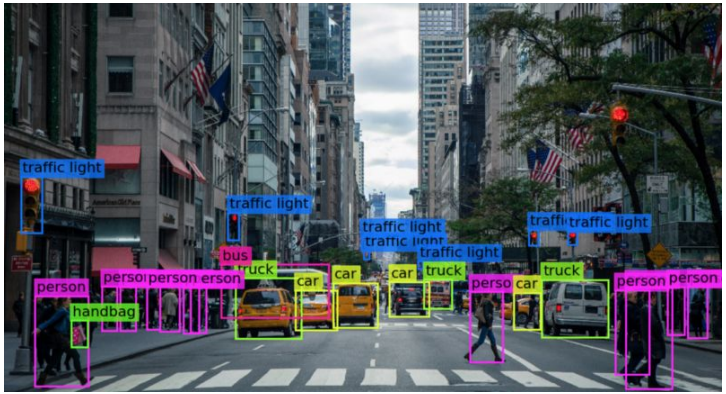
- The applications of Computer vision can be enhanced
  - via the use of a referential knowledge base of facts
    - about the objects it has been trained to identify.
- We use this to create an app called “The Lazy Chef”
  - uses computer vision to identify grocery store ingredients
  - tells you want kinds of dishes you can make.

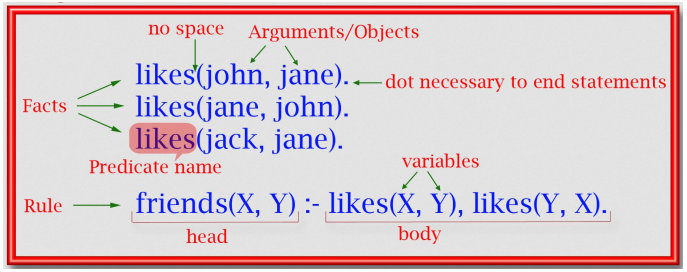




recipe(apple, apple_sauce).

Introduction

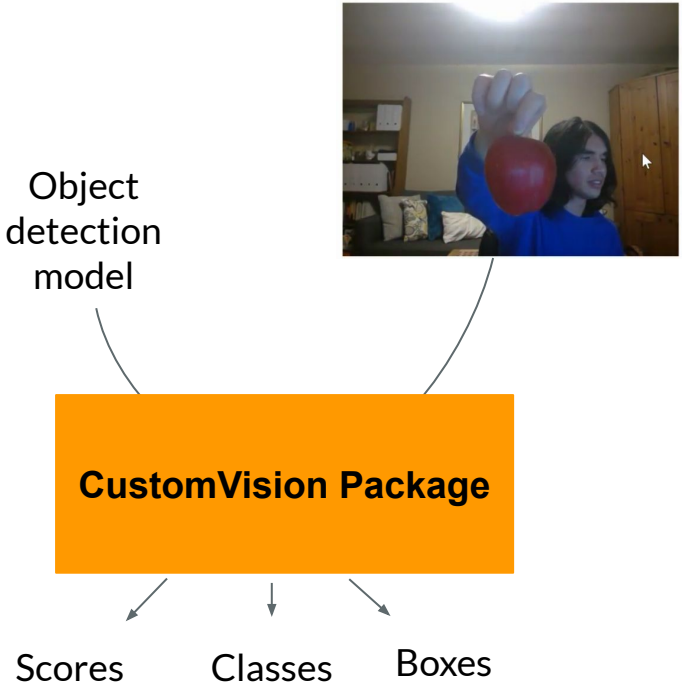




- Regular computer vision systems don't care about the relationships between the objects they see
- Attach it to a knowledge base so it can!

Methods/Algorithms/Concepts

- CustomVision: recognizes objects
- Tau-prolog: can reference the knowledge base with javascript
- Prolog Knowledge Base: filled with the relations we need to reference

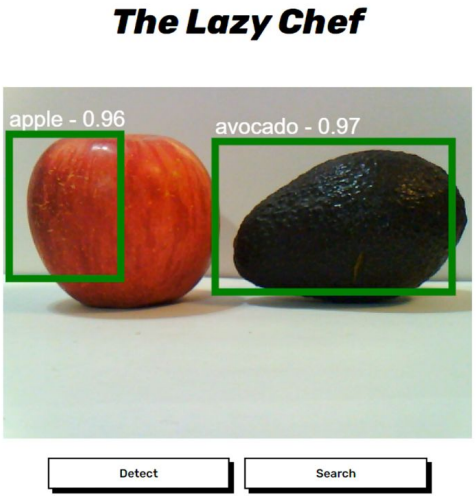


Experiments

- Started at a classification model: used video feed and a custom trained model to identify the items on screen
- Moved to an object detection model: continued to use video feed but relied on a pretrained obj detection model
    - This had limitations as the pretrained model didn't care about the ingredients we were looking at
    - Used ml5 which was restricted by using only pretrained models
- Moved to using tf.js with React: allowed the use of custom trained models but in contrast boots up very slowly and interprets frames very slowly.
- Changed from having a live video feed to using a snapshot method.

Experiments

- Ran tests on different ingredients at our disposal
- Recognizes certain ingredients well
  - Apple, avocado, bell pepper, egg, butter, sausage, garlic, onion
- Struggles with other ingredients
  - Bread, tortilla, asparagus, carrot, shredded cheese, ketchup, etc,,,
- With more resources, model can be improved
- Recipe finding through unification works well



Future Work

- More robust model
  - More ingredients
  - Higher accuracy
- Increase database of recipes
  - Filterable
- Adding search functionality
  - By ingredient(s)
  - Caloric limits
  - Diet type(s)

Future Work

- Integration into IoT devices
  - Refrigerators
- Optimize ingredient identification
- Remove necessity for snapshot
- Integrate with grocery delivery services
- Develop working mobile application

Conclusion

- Allowing a computer vision system to interact with a knowledge base
  - has a wide array of applications within the real world
  - beyond having it tell you what to make for dinner.
- Classical AI makes up for what modern AI lacks
  - Such as finding relations
- Combining modern AI and Classical AI can be used for our use case
  - Finding recipes from detected ingredients

Future Work

- A much more diligently and highly trained model
- A bigger more in depth knowledge base of recipes
- Display more information other than recipes
  - Nutrition facts, where to buy, etc...
- Scale and optimize more
- Mobile app