

Food Scanner Application - Inverse Cooking System in Backend

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Outline

- 1 Introduction
- 2 Existing System
- 3 Proposed System
- 4 Architecture
- 5 Modules
- 6 Module Description
- 7 Data Flow Diagram
- 8 Sample Result
- 9 Conclusion
- 10 Reference

Introduction

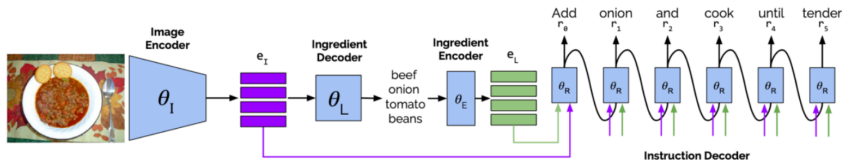
- Deep learning can be defined as the method of machine learning and artificial intelligence that is intended to imitate humans and their actions based on certain human brain functions to make effective decisions. In deep learning, a computer model learns to perform classification tasks directly from images, text, or sound.
- A convolutional neural network is a specific kind of neural network with multiple layers. It processes data that has a grid-like arrangement then extracts important features. One huge advantage of using CNNs is that you don't need to do a lot of pre-processing on images.
- The goal of this project was to use the largest publicly available collection of recipe data (Recipe1M+) to build a Food Scanning Application for ingredients and recipes. Train, evaluate and test a model able to predict title, ingredients and recipe. Finally, to build Food Scanning application.

- In the past, algorithms have been using simple systems of recipe retrieval based on image similarities in some embedding space. This approach is highly dependent on the quality of the learned embedding, dataset size and variability.
- Therefore, these approaches fail when there is no match between the input image and the static dataset .
- Inverse cooking algorithm instead of retrieving a recipe directly from an image, proposes a pipeline with an intermediate step where the set of ingredients is first obtained.
- This allows the generation of the instructions not only taking into account the image, but also the ingredients.

Proposed System

- Recipe1M affords the ability to train high-capacity models on aligned, multi-modal data. Using these data, train a neural network to learn a joint embedding of recipes and images that yields impressive results on an image-recipe retrieval task.
- The Food Scanner Application which works with the help of 1M+ Dataset which works in the backend.
- The user can easily access the details of scanned food item.

- Inverse Cooking recipe generation model with the multiple encoders and decoders, generating the cooking instructions



- MODULE 1
 - Encoder
 - 1.1 Image Encoder
 - 1.2 Ingredient Encoder
- MODULE 2
 - Decoder
 - 2.1 Instruction Decoder
 - 2.1 Ingredient Decoder

Module Description

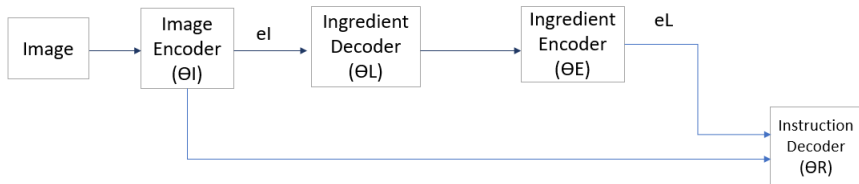
- Image Encoder - We extract image features e_I with the image encoder, parametrized by θ_I .
- Ingredient Decoder - Ingredients are predicted by θ_L
- Ingredient Encoder - encoded into ingredient embeddings e_L with θ_e .
- Cooking instruction decoder - parametrized by θ_R generates a recipe title and a sequence of cooking steps by attending to image embeddings e_I , ingredient embeddings e_L , and previously predicted words (r_0, \dots, r_{t-1}).

Algorithm

- This recipe retrieval algorithm was developed by the Facebook AI Research and it is able to predict ingredients, cooking instructions and a title for a recipe, directly from an image .
- We applied CNN to the tasks of food detection and recognition through parameter optimization. We constructed a dataset of the most frequent food items in a publicly available 1M+ Dataset, and used it to evaluate recognition performance.
- PyTorch : All models are implemented with PyTorch. The greedy search function implements Greedy Search, which simply picks the most likely token at every step. This is the fastest and simplest algorithm, but can work well if the model is properly trained.
- Resnet50 is a pre-trained Deep learning model. A pre-trained model is trained on a different task than the task at hand and provides a good starting point since the features learned on the old task are useful for the new task.

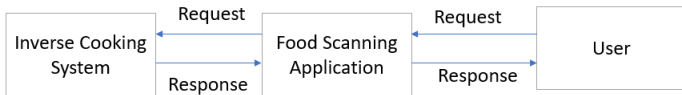
Data Flow Diagram I

- 1. Inverse Cooking System (Backend Working)



Data Flow Diagram II

- 2. Food Scanner




Sample Result

localhost:8888/notebooks/inversecooking-master/src/demo.ipynb

jupyter demo Last Checkpoint: Yesterday at 12:19 PM (autosaved)

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3

Run



RECIPE 1

Title: Beef burgers

Ingredients:
pepper, bun, salt, onion, cheese, beef, oil, lettuce, worcestershire_sauce

Instructions:

- In a large bowl, combine the beef, worcestershire sauce, salt, pepper, and onion.
- Form into 4 patties.
- Heat the oil in a large skillet over medium heat.
- Cook the patties for 5 minutes on each side, or until well done.
- Top each patty with a slice of cheese.
- Cover and cook for 1 minute or until cheese is melted.
- Place the burgers on buns and top with lettuce, tomato, and onion.

RECIPE 2

Title: Bleu cheese burgers

Ingredients:
pepper, bun, salt, onion, cheese, beef, oil, lettuce, worcestershire_sauce

Instructions:

- Preheat an outdoor grill for high heat and lightly oil the grate.
- Lightly oil the grate.
- Mix ground beef, blue cheese, worcestershire sauce, red onion, red pepper flakes, salt, and pepper together in a bowl.
- Form the beef mixture into four 1/2-inch patties.

Sample Result Cont...

The screenshot shows a Jupyter Notebook running in a web browser at the URL `localhost:8888/notebooks/inversecooking-master/inversecooking-master/src/demo.ipynb`. The notebook is titled "demo Last Checkpoint: Yesterday at 12:19 PM (autosaved)". The interface includes a menu bar (File, Edit, View, Insert, Cell, Kernel, Widgets, Help) and a toolbar with icons for file operations, cell execution, and code editing. The notebook content is displayed in a code cell with a light blue background. It contains a recipe for "Grilled Hamburgers" with the following structure:

```
Ingredients:
pepper, bun, salt, onion, cheese, beef, oil, lettuce, worcestershire_sauce

Instructions:
-Preheat an outdoor grill for high heat and lightly oil the grate.
-Lightly oil the grate.
-Mix ground beef, blue cheese, worcestershire sauce, red onion, red pepper flakes, salt, and pepper together in a bowl.
-Form the beef mixture into four 1/2-inch patties.
-Cook the burgers on preheated grill until the meat is no longer pink in the center, about 4 minutes per side.
-An instant-read thermometer inserted into the center should read 160 degrees f (70 degrees c).
-An instant-read thermometer inserted into the center should read at least 165 degrees f (74 degrees c).
=====
RECIPE 3

Title: Grilled hamburgers

Ingredients:
pepper, bun, salt, onion, cheese, beef, oil, lettuce, worcestershire_sauce

Instructions:
-In a medium bowl, mix together beef, worcestershire sauce, onion and salt and pepper to form the mixture into patties.
-Heat oil in a large skillet over medium-high heat.
-Pan-fry burgers in skillet, turning once, until cooked through and juices run clear, about 10 minutes.
-Place burgers on hamburger buns, top with cheese, and continue to cook until cheese melts and burgers are heated through, about 5 more minutes.
=====
RECIPE 4

Title: Beef burger with cheddar and onions and green onions

Ingredients:
pepper, bun, salt, onion, cheese, beef, oil, lettuce, worcestershire_sauce

Instructions:
-Combine ground meat or turkey, worcestershire sauce, salt and pepper; form into 8 patties.
-Heat oil in a large skillet over medium heat.
-Add burgers to skillet; cook, turning once, until cooked through and juices run clear, 6 to 8 minutes for medium.
-Top each burger with a slice of cheddar cheese; cover skillet and cook until cheese melts, 2 to 3 minutes.
-Spread bottom halves of buns with lettuce.
-Place burgers over lettuce; top with onion.
=====
```

Sample Result Cont...

localhost:8888/notebooks/inversecooking-master/inversecooking-master/n2/demo.ipynb


jupyter demo Last Checkpoint: Yesterday at 12:19 PM (autosaved)

File Edit View Insert Cell Kernel Widgets Help

Run Code

Log out

Python 3



RECIPE 1

Title: BLT sandwich

Ingredients:
bread, tomato, lettuce, mayonnaise, pepper, bacon

Instructions:
-Spread mayonnaise on one side of each slice of bread.
-Layer lettuce, tomato, bacon, and pepper on one slice of bread.
-Top with remaining slice of bread.

RECIPE 2

Title: BLT sandwiches with chipotle mayo

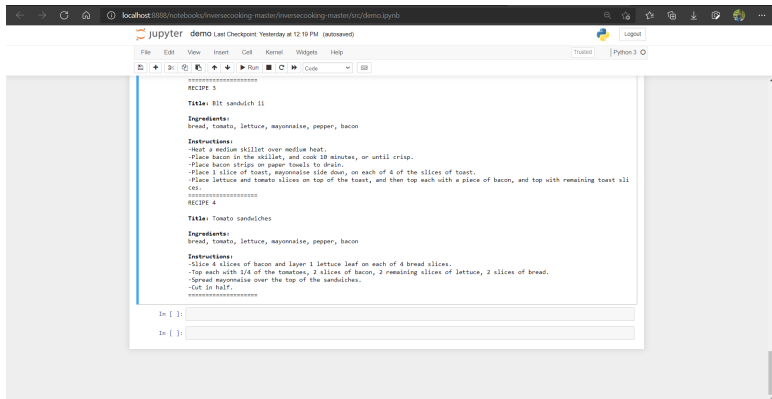
Ingredients:
bread, tomato, lettuce, mayonnaise, pepper, bacon

Instructions:
-Spread 1 tbsp chipotle mayo onto one side of each bread slice; top evenly with lettuce, tomato, bacon and second bread slice.
-Combine mayo and pepper; spread over sandwiches.
-Cut each sandwich into 4 triangles.

RECIPE 3

Title: BLT sandwich ii

Sample Result Cont...



The screenshot shows a Jupyter Notebook interface in a web browser. The address bar indicates the URL is localhost:8888/notebooks/inversecooking-master/inversecooking-master/src/demo.ipynb. The notebook title is "demo Last Checkpoint Yesterday at 12:19 PM (autosaved)". The interface includes a menu bar (File, Edit, View, Insert, Cell, Kernel, Widgets, Help), a toolbar with icons for file operations and execution, and a status bar showing "Python 3". The main content area displays two recipes, each separated by a line of asterisks.

```
*****
RECIPE 3

Title: Blt sandwich II

Ingredients:
bread, tomato, lettuce, mayonnaise, pepper, bacon

Instructions:
-Heat a medium skillet over medium heat.
-Place bacon in the skillet, and cook 10 minutes, or until crisp.
-Place bacon strips on paper towels to drain.
-Place 1 slice of toast, mayonnaise side down, on each of 4 of the slices of toast.
-Place lettuce and tomato slices on top of the toast, and then top each with a piece of bacon, and top with remaining toast slices.
*****
RECIPE 4

Title: Tomato sandwiches

Ingredients:
bread, tomato, lettuce, mayonnaise, pepper, bacon

Instructions:
-Slice 4 slices of bacon and layer 1 lettuce leaf on each of 4 bread slices.
-Top each with 1/4 of the tomatoes, 2 slices of bacon, 2 remaining slices of lettuce, 2 slices of bread.
-Spread mayonnaise over the top of the sandwiches.
-Cut in half.
*****
```

Below the code area, there are two input fields for the Jupyter console, each preceded by "In []:".

- The image-to-recipe generation system, which takes a food image and produces a recipe consisting of a title, ingredients and sequence of cooking instructions. We first predicted sets of ingredients from food images, showing that modeling dependencies matters. Then, we explored instruction generation conditioned on images and inferred ingredients, highlighting the importance of reasoning about both modalities at the same time.
- The accuracy of food detection can be made even more accurate by training the layers.



1. *Recipe1M+: A Dataset for Learning Cross-Modal Embeddings for Cooking Recipes and Food Images – MIT*
2. *Food Detection with Image Processing Using Convolutional Neural Network (CNN) Method — IEEE Conference Publication — IEEE Xplore*
3. (PDF) *Food Image Recognition by Using Convolutional Neural Networks (CNNs)* (researchgate.net)
4. *simplified-recipes-1M Dataset - Dominik Schmidt*
Slide 1 (nvidia.com)
5. [PDF] *Deep Learning Based Food Recognition — Semantic Scholar*
6. *Food Ingredients and Recipes Dataset with Images — Kaggle*

Thank You