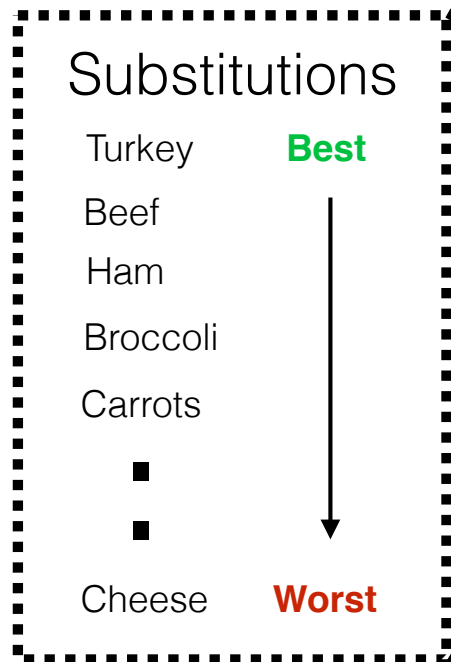


Recipe Scoring with a Recurrent Neural Network Sequence-to-Sequence Model

Kien Wei Siah and Paul Myers

Objective



Chicken Pasta

Ingredients

Chicken
Pepper
Cheese
Pasta Noodles
Butter
Seasoning Mix

Directions

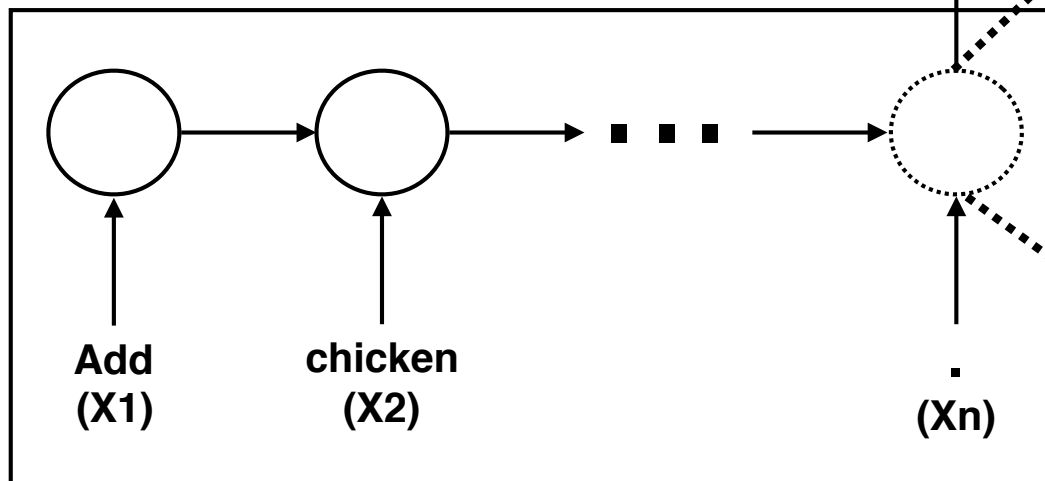
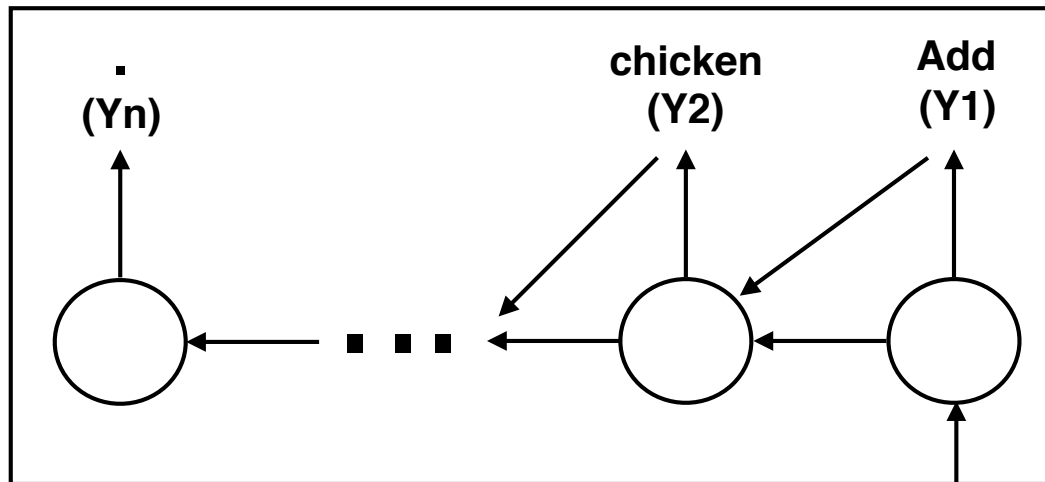
1. Chop **chicken** and place in a bowl.
2. Toss in seasoning mix.
3. Saute **chicken** in butter.
4. Reduce heat.
5. Add pepper to **chicken** mixture.
6. Heat thoroughly.
7. Pour **chicken** mixture over hot pasta.
8. Serve **chicken** and pasta with cheese.

For a given recipe:

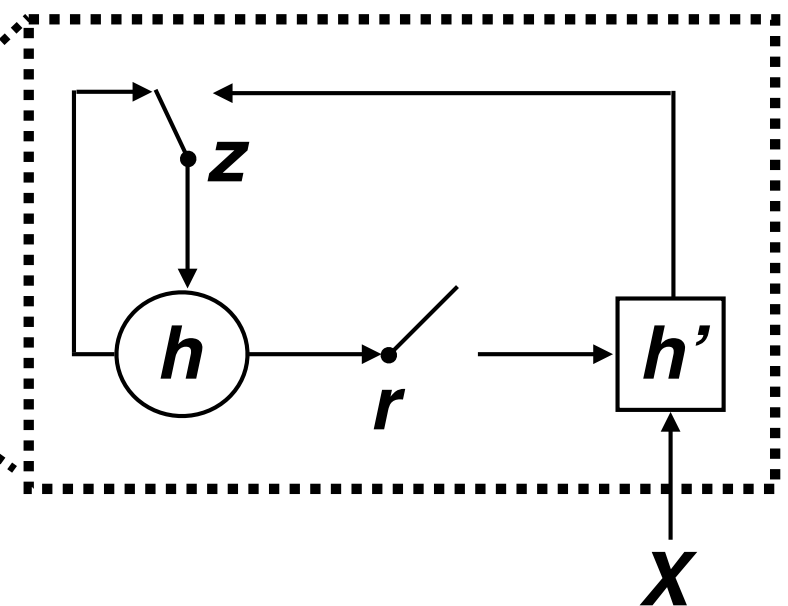
- 1. Choose an ingredient to replace**
- 2. Choose a replacement criterion**
- 3. Rank the possible substitutes**
- 4. Generate a modified recipe**

Sequence-to-Sequence Model

Decoder

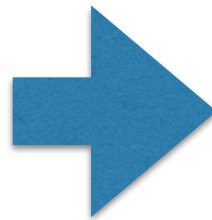


Gated Recurrent Unit

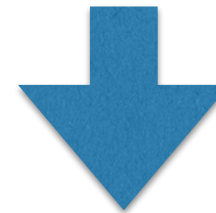


Encoder

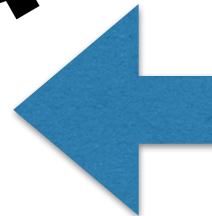
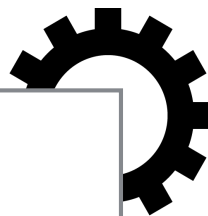
Data Collection



Web Crawling



Text Preprocessing



heat oil in a large pot over medium heat until hot.
add onion and garlic to oil.
saute for 5 minutes or until onion is tender.
stir in tomatoes with liquid
in an 8 quart pot
combine mayonnaise
melt butter and add garlic in a medium saucepan.
cook over medium for 1 minute.
add flour and cook 1 minute
place chicken and cajun seasoning in a bowl and toss to coat.
in a large skillet over medium heat
cook pasta according to directions
saute onions



Basic Pasta



allrecipes

Recipe By: Pat

"An easy recipe and simple to double or triple, depending on amount needed. Hope you enjoy!"

Ingredients

1 egg, beaten
1/2 teaspoon salt

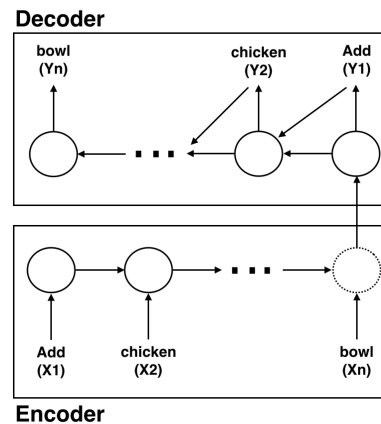
1 cup all-purpose flour
2 tablespoons water

Directions

- 1 In a medium sized bowl, combine flour and salt. Make a well in the flour, add the slightly beaten egg, and mix. Mixture should form a stiff dough. If needed, stir in 1 to 2 tablespoons water.
- 2 On a lightly floured surface, knead dough for about 3 to 4 minutes. With a pasta machine or by hand roll dough out to desired thinness. Use machine or knife to cut into strips of desired width.

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Training Procedure



Epoch 1
In: add chicken to the bowl.
Out: **add salmon to the pasta.**

■
■
■

Epoch N
In: add chicken to the bowl.
Out: **add chicken to the bowl.**

Procedure:

1. Tokenize recipes into sentences
2. Input each sentence to the model
3. Repeat until model outputs the input sentence

Model was trained on ~19,000 sentences, validated on ~6,500 sentences, and tested on ~6,500 sentences

Example Run of Model

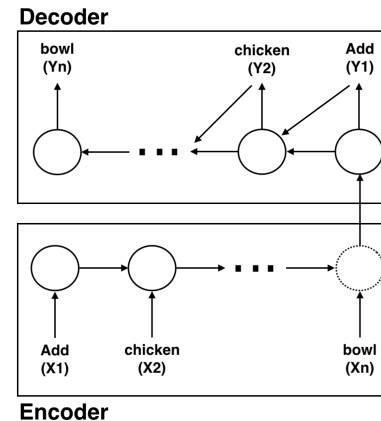
1. Chop **<WORD>** and place in a bowl.
2. Toss in seasoning mix.
3. Saute **<WORD>** in butter.
4. Reduce heat.
5. Add pepper to **<WORD>** mixture.
6. Heat thoroughly.
7. Pour **<WORD>** mixture over hot pasta.
8. Serve **<WORD>** and pasta with cheese.

Template Recipe



Chicken
Beef
Salmon
Broccoli
Turkey
Onions
■
■

**List of All
Ingredients in Corpus**



Chicken: 5.01
Beef: 7.04
Salmon: 10.11
Broccoli: 25.21
Turkey: 6.11
Onions: 11.22
■
■

**Average
Perplexity
Scores**

Procedure:

1. Replace all occurrences of chosen ingredient with **<WORD>**
2. For each ingredient in the test corpus, replace all occurrences of **<WORD>** with the current ingredient
3. Calculate the average perplexity of the recipe with the given ingredient in place

Results

1. Chop **chicken** and place in a bowl.
2. Toss in seasoning mix.
3. Saute **chicken** in butter.
4. Reduce heat.
5. Add pepper to **chicken** mixture.
6. Heat thoroughly.
7. Pour **chicken** mixture over hot pasta.
8. Serve **chicken** and pasta with cheese.

Original Recipe

1. Chop **broccoli** and place in a bowl.
2. Toss in seasoning mix.
3. Saute **broccoli** in butter.
4. Reduce heat.
5. Add pepper to **broccoli** mixture.
6. Heat thoroughly.
7. Pour **broccoli** mixture over hot pasta.
8. Serve **broccoli** and pasta with cheese.

1. Chop **beef** and place in a bowl.
2. Toss in seasoning mix.
3. Saute **beef** in butter.
4. Reduce heat.
5. Add pepper to **beef** mixture.
6. Heat thoroughly.
7. Pour **beef** mixture over hot pasta.
8. Serve **beef** and pasta with cheese.

Baseline: Bigram Language Model

Other suggestions: Onions, beef, turkey

Average accuracy: **54.5%**

Proposed: RNN Model

Other suggestions: Broccoli, onions, turkey

Average accuracy: **45.5%**

Note: Results are preliminary and are expected to improve with more test data

Ongoing and Future Work

Optimize network parameters:

- 1. Number of layers**
- 2. Number of hidden units**
- 3. Word vector dimensions**
- 4. Batch size**
- 5. Initialization methods (Word2Vec)**

Continue to test model with larger test set