Recipe for Disaster: A Seq2Seq Model for Recipe Generation

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Background

- RNNs have had success at producing locally coherent text
- Recipe instruction generation is particularly challenging: references specific ingredients, global coherence
- Globally coherent recipe generation relatively unexplored
- Polmareddi et. al (2015): Cuisine classification and generation with MDPs
- Brewe et. al (2015): Recipe generation with char-rnn
- Choi et. al (2016): Globally coherent text generation

Problem Statement

- Input a set of ingredients
- Output a sequence of instructions that govern the combination of these ingredients
- Mimic the style and syntax of a human written recipe
- Incorporate all ingredients into instructions

Dataset

- The dataset used in our model was the MIT Recipe1M database
- Consists of over 1 million recipes consisting of a list of ingredients and instructions
- We split the data as follows:
  - Train: 95% of recipes
 - Development: 2.5% of recipes
  - Test: 2.5% of recipes

Ingredients	Instructions
spiral shaped pasta	1. Cook pasta according to package directions and drain.
pepperoni	2. Pour into large mixing bowl.
ground beef	3. Finely chop half of the pepperoni.
pizza sauce	4. ...
mozzarella cheese	5. Pour in lightly greased casserole dish.
dried parsley	6. Sprinkle remaining half of cheese over top.
onion powder	7. Place remaining pepperoni slices on top.
garlic	8. Sprinkle with parsley.
	9. Bake in 350 degree oven until cheese bubbles.

## Model

Architecture

$$L_{preds} = \sum_{i=0}^{T} CE(y_i, \hat{y}_i)$$
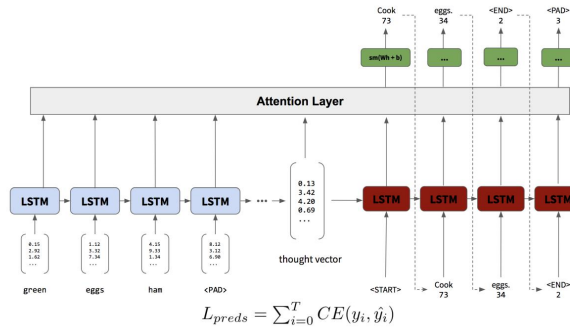
Results
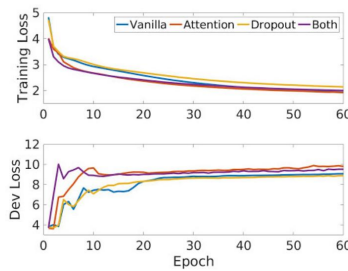
	PP (Train)	PP (Dev)	BLEU (Dev)
Vanilla Seq2Seq	3.83	539.84	0.0614
Attention	**3.80**	892.52	**0.0812**
Dropout	4.42	**474.04**	0.0598
Attention + Dropout	4.02	736.35	0.0615

ingredients	model output	reference recipe
self rising flour milk mayonnaise dried tarragon garlic powder	mix all ingredients together and roll into balls and bake at 350 degrees for 20 minutes	preheat oven to 425 degrees coat 12 muffin cups with nonstick cooking spray in a bowl combine all ingredients mix well divide batter equally amongst muffin cups bake 12 to 15 minutes or until golden serve warm
water rice	combine all ingredients in a small saucepan bring to a boil reduce heat and simmer for 10 minutes remove from heat and let cool and let cool	bring water to a boil in wok on high setting stir in rice and cover reduce heat to medium and simmer 15 minutes or until all water is absorbed turn off heat and allow rice to sit 5 minutes fluff with a fork and serve
raspberry lime juice sparkling ginger ale ice crushed	pour all ingredients in a blender and blend until smooth	blend all ingredients on high until frothy
vanilla vodka sour apple liqueur	pour the vodka and vodka in a cocktail shaker filled with ice shake vigorously strain into a chilled cocktail glass garnish with a lime wedge	shake with ice and strain into a chilled cocktail glass
pomegranate juice chilled prosecco sparkling wine chilled	pour the grapefruit juice into a champagne flute and stir well	pour pomegranate juice into champagne flutes dividing equally and add chilled wine over the fruit juice
butter all-purpose flour cheddar cheese cayenne pepper	mix all ingredients together and chill for 1 hour or until golden brown	cheese and make sure all 3 ingredients are blended well together shape into marble sized balls place on ungreased baking sheet bake at 350 degrees for 10 minutes or until done

Data Pruning
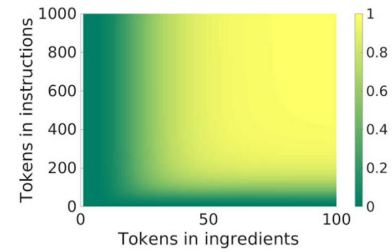
Experiments

- Regularization/Dropout
- Luong Attention
- Beam Search
- Pretrained word embeddings

Conclusion

- We were successfully able to minimize the training loss and generate novel recipes for ingredients
- More work is needed to generalize more effectively to unseen examples
- Dev loss is not strictly predictive of performance
- Categorical inference
- Further work:
  - Dependency Parsing
  - Checklist Specialized Attention
  - Bidirectional encoder
  - RNN Cell Type (GRU vs Vanilla vs LSTM)
  - Specialized metrics for model evaluation