**Overview**

**Motivation:**
- Exploding demand for craft beer
- Designing new beers relies on trial and error

**Goal:**
- Optimize beer recipe generation to design better tasting beers, with less effort

**Approach:**
- Use deep and recurrent neural networks to learn (and map between) representations of beer in different domains

**Background**

**Long Short Term Memory Networks**
- Specializes in modeling sequential data
- Memory cells store relevant long-term info

\[
i_t = \sigma(W_i x_t + U_i h_{t-1} + b_i) \\
\tilde{c}_t = \tanh(W_c x_t + U_c h_{t-1} + b_c) \\
f_t = \sigma(W_f x_t + U_f h_{t-1} + b_f) \\
C_t = i_t \odot \tilde{c}_t + f_t \odot C_{t-1} \\
o_t = \sigma(W_o x_t + U_o h_{t-1} + V_o C_t + b_o) \\
h_t = o_t \odot \tanh(C_t) \\
y = \text{softmax}(h)
\]

**Beer Recipes**
- Fermentables: affect sweetness, body, color, alcohol content
- Hops: give bitter, zesty, citric flavors
- Yeasts: affect alcohol content, flavor, aroma
- Miscellaneous: affects clarity and flavor

**Models**

**DNN**

**LSTM-DNN**

**Encoder-Decoder**

**Experimental Setup**

**Data**

**Training**
- Developed using Tensorflow, Scikit-learn
- Bayesian hyperparameter tuning
- Stochastic gradient-based optimization

**Results**

**Future Work**
- Generate meaningful representations of beer recipes using encoder-decoder model
- Create combined model of recipes and reviews
- Generate beer recipes and reviews