# RecipeScape: An Interactive Tool for Analyzing Cooking Instructions at Scale

Minsuk Chang [1], Léonore V. Guillain [2], Hyeungshik Jung [1], Vivian Hare [3], Juho Kim [1], Maneesh Agrawala [3]

[1] KAIST School of Computing [2] EPFL École Polytechnique Fédérale de Lausanne [3] Stanford Engineering Computer Science

KAIST Interaction Lab
minsuk@cs.kaist.ac.kr

CHI 2018 Engage with CHI
Montréal, Canada • April 21-26

https://recipescape.kixlab.org

## Background and Motivation

**Professional culinary analytics**
→ browsing, analyzing and understanding hundreds of recipes for a single dish

**Recipe sharing online: thousands of recipes by people even for a single dish**
→ naturally crowdsourced human collective knowledge in procedural forms!

**Current recipe analytics only focus on ingredient level**
→ we propose a new perspective, "Recipe = Process"

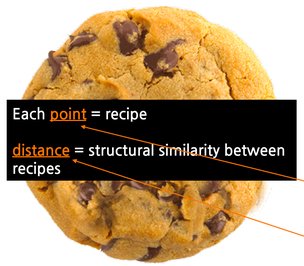
## System Design Goals

**D1. individual ingredient/cooking action level**
ex) "what are some unusual ingredients?", "what are some unusual cooking actions?"

**D2. instruction level**
ex) "what are the detailed step by step instructions of this recipe?", "what are shared instructions and ingredients between two recipes?"

**D3. cluster level analysis**
ex) "what makes a set of recipes standard of the dish?", "what are some creative variants of this recipe?"

## RecipeScape Prototype Interface



Each point = recipe

distance = structural similarity between recipes

**a.RecipeMap**

RecipeMap for Chocolate Chip Cookie

Group By

Clusters: select all unselect all

Select cluster(s)

Automatically updates RecipeStat and updates statistics of recipes in the selected cluster(s)

**b.RecipeDeck**

RecipeDeck

remove all save deck saved decks:

Matcha-White Chocolate Sugar Cookies

Oatmeal Trail Mix Cookies

Select individual recipe

Select two recipe cards

Detailed view

Mini Chocolate Sandwich Cookies vs Island Macaroons

Oatmeal Trail Mix Cookies vs Brownie Sundae with Banana Chips

Pairwise Comparison View

Chocolate-Dipped Ice Cream Sandwiches

Individual Recipe View

**c.RecipeStat**

RecipeStat

Actions

beat add preheat cool bake stir

cookies butter dough chocolate sugar flour

beginning middle end

Select ingredient

Select action

butter beat cream add

Graphs cooking action - Ingredient pair (vice versa) usage patterns

"Histogram" of when each cooking action and ingredient is used

## Comp. Pipeline

**Custom Annotation Tool**

Cooking Action
Ingredient
Cancel
Press Enter or click submit to proceed

Granola and Dried Cranberry Chocolate Chip Cookies

Preheat oven to 350°F.
In a bow whisk together flour, baking soda, baking powder, and salt.
In another bowl with an electric mixer cream butter and sugar until light and fluffy.
Beat in egg, beating until combined well, and beat in vanilla.
Beat in flour mixture and stir in remaining ingredients.
Drop dough by rounded tablespoons 2 inches apart onto buttered baking sheets and bake in batches in middle of oven
Cool cookies on racks.
Cookies keep in airtight containers 5 days.

Already Checked
Current Sentence
Submit

**1. Recipe Text**
Stir in remaining 6 tablespoons corn syrup and vanilla.

**2. Part-Of-Speech Tags** (Stanford CoreNLP)
Stir in remaining 6 tablespoons corn syrup and vanilla.
NNP IN JJ CD NN NN NN NN

**3. Human Annotation**
fix merge approve
Stir in remaining 6 tablespoons corn syrup and vanilla.
Cooking Action Ingredients Ingredients

**4. Tree Representation**
corn syrup vanilla stir

**5. Calculate Distance between Trees**
corn syrup vanilla stir
corn syrup vanilla cream mix

- Replace 'vanilla' with 'cherry': (+ distance('vanilla','cherry'))
- Add 'cream' (+ 1)
- Replace 'stir' with 'mix': (+ distance('stir','mix'))

**6. Plotting Distances**

| | A | B | C | D |
|---|---|---|---|---|
| A | 0 | 1 | 3 | 4 |
| B | 1 | 0 | 2 | 1 |
| C | 3 | 2 | 0 | 2 |
| D | 4 | 1 | 2 | 0 |

Distance Matrix

| | x | y |
|---|---|---|
| A | 0 | 1 |
| B | 1 | 0 |
| C | 2 | 1 |
| D | 3 | 2 |

Gram Matrix

Hierarchical Clustering

## Results - Example Usage Patterns

**D1. Ingredient and action level analysis**
ex) examined RecipeStat for recipes where "cover" appears late to find cookie recipes with decorations

**D2. Individual recipe level analysis**
ex) pairwise comparison of two adjacent recipes on RecipeMap to examine replaceable ingredients and actions

**D3. Cluster level analysis**
ex) to find recipes without eggs, find clusters with baking soda and baking powder in RecipeStat

## RecipeScape is useful for:

**Culinary students**
- For competitions, simulating creative recipes
- For classroom projects to learn about one dish comprehensively

**Cooking journalists:**
- Want to use RecipeScape for Korean food to see how it's westernized

## Acknowledgements

The Brown Institute for Media Innovation · IITP · KAIST · HCI@KAIST