

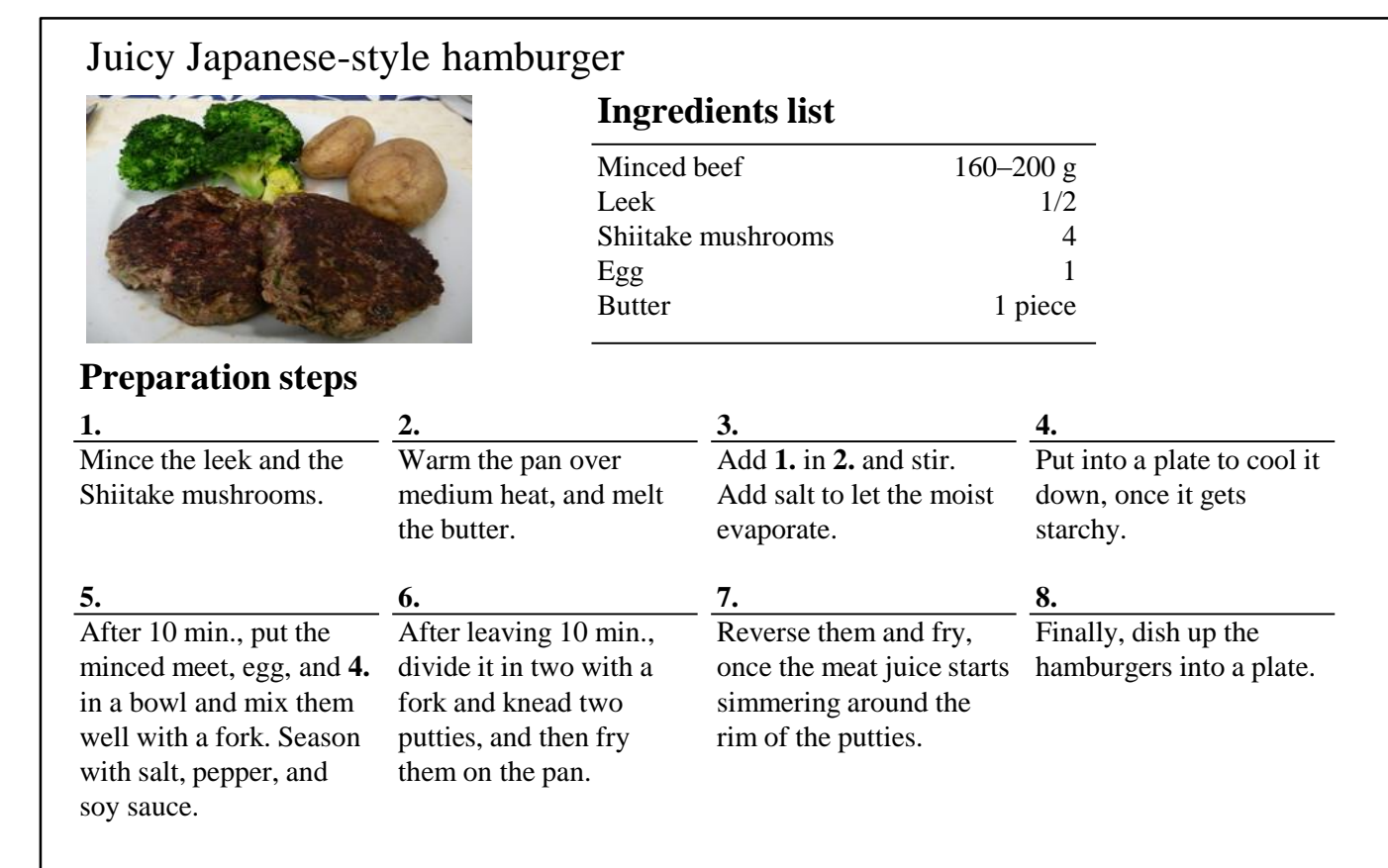
# Tastes and Textures Estimation of Foods based on the Analysis of Its Ingredients List and Image

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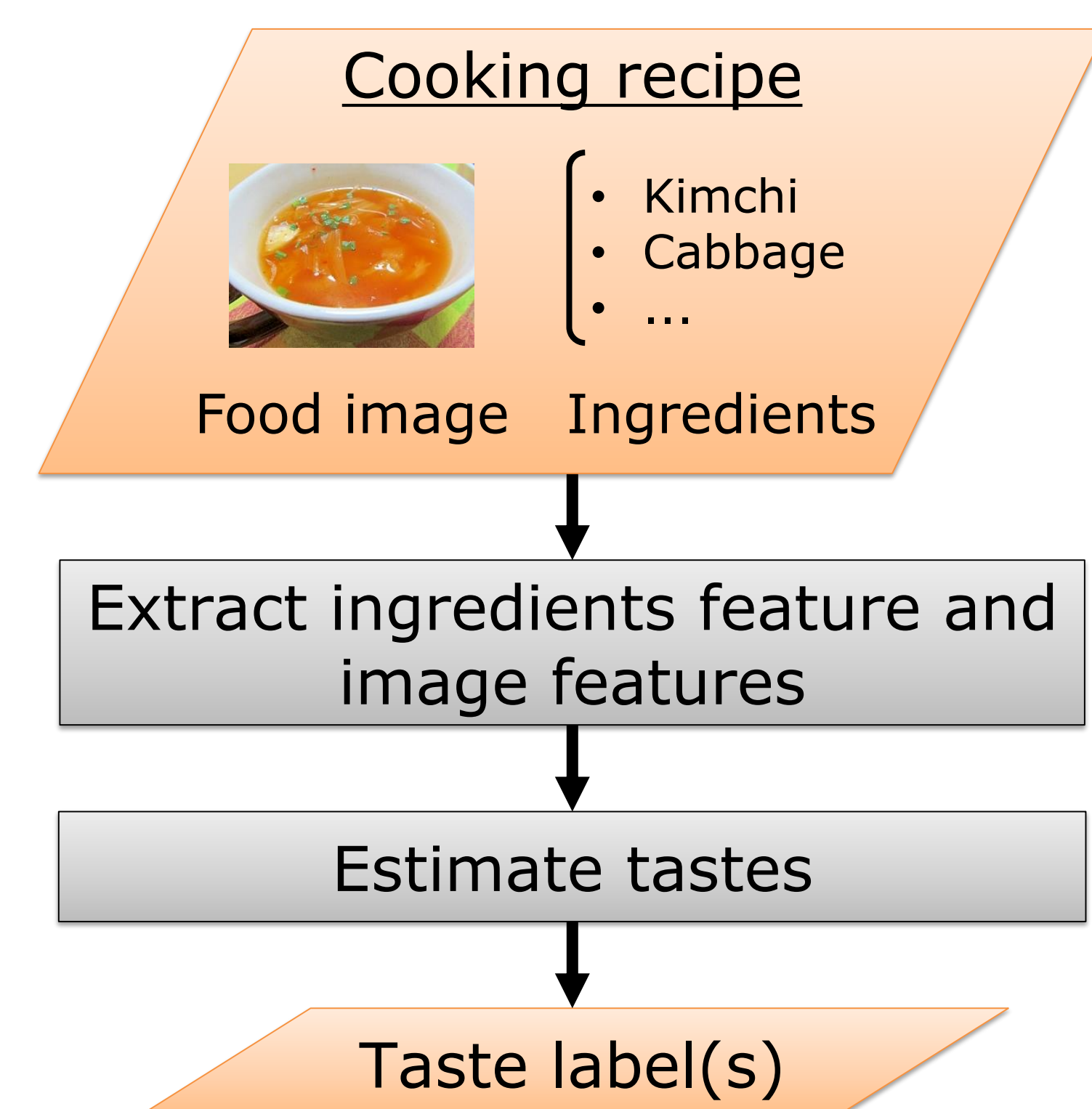
## Introduction

- **Background:** Numerous cooking recipes posted on the Web
  - Search by keyword matching with recipe titles or ingredient names
  - ➔ Difficult to search by tastes and/or textures
- **Purpose:** Tastes and textures estimation from a cooking recipe



## Proposed Method

- **Concept:** Focus on the correlations between
  - Ingredients and taste (Ex. Pineapple should be sweet and/or sour)
  - Appearance and taste (Ex. Red foods are likely to be chilly)
- **Framework:** One-vs.-rest classifier for each taste class
  - Classifiers: Linear SVMs using two kinds of features
  - Ingredients feature: Binary vector representing the ingredients used in a cooking recipe
  - Image features: Composition of several image features
    - Color: Hue-saturation histogram and correlogram
    - Gradient: SIFT+BoF and HOG



## Experiments

- **Dataset:** Rakuten Recipe dataset
  - Labeled automatically by referring to user comments posted to each cooking recipe
    - 7,706 cooking recipes for taste estimation
    - 5,219 cooking recipes for textures estimation
- **Condition:** 8-fold cross validation
  - Evaluation criteria: F-measure
- **Exp.1:** Tastes estimation
  - Results: Using both features was effective for almost all the taste classes
- **Exp.2:** Textures estimation
  - Results: Using only the ingredients feature was effective for some texture classes

Exp.1) Taste class	# of Samples	Feature		
		Ingredients	Image	Both (Proposed)
Sweet	4,849	0.787	0.705	<b>0.797</b>
Salty	495	0.144	0.152	<b>0.287</b>
Sour	1,093	0.373	0.243	<b>0.409</b>
Chilly	907	<b>0.388</b>	0.298	0.345
Bitter	362	<b>0.462</b>	0.144	<b>0.462</b>

Exp.2) Texture class	# of Samples	Feature		
		Ingredients	Image	Both (Proposed)
Shaki-shaki	1,445	<b>0.732</b>	0.514	0.726
Fuwa-fuwa	1,353	0.643	0.432	<b>0.645</b>
Toro-toro	843	<b>0.378</b>	0.310	0.363
Saku-saku	828	0.526	0.346	<b>0.539</b>
Hoku-hoku	750	<b>0.660</b>	0.333	0.650

## Summary

- **Conclusion:** Proposed method is
  - Effective for tastes estimation
  - Extensible to textures estimation
- **Future work:** Performance improvement
  - Adaptive feature selection for each taste or texture class