Automatic Construction of Ingredients Dictionary for Animation of Cooking Action

Masayasu Takeshima (0610056)

School of Information Science,
Japan Advanced Institute of Science and Technology

February 7, 2008

Keywords: cooking recipe, animation, ingredients, dictionary.

In this research, we aim at the construction of system that generates animation from cooking recipe on demand and presents it to user to support user's understanding of the recipe. It is based on the system proposed by Ookawa et al.. Animation generation of that system is based on action dictionary that including basic actions expression and their corresponding animation. The action dictionary contains several entries with different animations for the same linguistic expression of an action. For instance, let us consider the action "kushigata-giri-ni-suru"(cut into comb shape). For this expression, the animation such that cutting the ingredient into comb shape after removing seed for the ingredient with seed is defined while animation such that only cutting the ingredient into comb shape for the ingredient without seed. However, the system of the previous research didn't have large scale knowledge about ingredients such that a certain ingredient has seed or not. Appropriate animation could not uniquely determined for the recipe sentence given by an user. In this research, we aim at constructing a large scale ingredient dictionary that exhaustively contains ingredients with their attributes. The attributes of the ingredient denoted in the ingredient dictionary are of sort, shape, and the presence of the component element(seed, peel, core). When animation is generated, an action and an ingredient are extracted from the recipe given by an user, required attribute of ingredient for the action in recipe sentence defined in

the action dictionary and attribute of ingredient defined by the ingredient dictionary are checked if they are the same, then appropriate animation is chosen for animation generation. In order to construct the ingredient dictionary, we try to automatically acquire ingredients and their attributes from the recipe corpus. Here a recipe corpus is a set on the recipe pages collected from Web.

In order to construct the ingredient dictionary, first it is necessary to collect a large amount of ingredients. In the recipe page, there are two areas; one is ingredient area where ingredients and their amount required for cooking are written by as a list, the other is cooking area where procedures of cooking are written. We proposes two techniques for collecting ingredients from these two areas. The first is a technique for collecting ingredients from ingredient area analysing structures of web pages. At first, ingredient area is detected by using keywords, HTML tags and so on. Then, ingredient area is divided by tag and blank, and candidates of ingredients are extracted. Finally, non-ingredients are removed by pattern matching etc. The accuracy of the ingredient extraction was 94.9% in our preliminary experiment.

The second is a technique for collecting ingredients by analyzing of the recipe sentences in cooking area and obtaining co-occurrence frequency between cooking actions and ingredients. That is, case filler nouns in topic case and accusative case of sentences where their predicates are cooking actions. The accuracy of ingredient extraction was 88% for the most 100 frequent extracted ingredients in our preliminary experiment. We evaluate our method to extract ingredients from recipe pages. The ingredient list consisting of 3395 ingredients was built by the technique of extracting ingredients from the ingredient area, was acquired, while the ingredient list consisting of 955 ingredients was built by the technique of extracting ingredients by capturing co-occurrence between actions and ingredients. These two ingredient lists are integrated, and the final ingredient list consisting of 3550 ingredients was constructed.

Next, we try to automatically acquire attributes of ingredients. The sort of ingredients was automatically determined according to semantic classes derived by a thesaurus and keywords. For instance, we prepare the rule such that the sort of ingredient whose semantic class is "vegetable" is

vegetable, or the sort of an ingredient containing a keyword "菜(Na)" is also vegetable, and so on. As a result, sort of ingredient was determined with almost 100% accuracy. The shape of ingredients was determined by referring numerative classifier. We consider that "hon" is used to count ingredients whose shape is like stick, while "mai" is used to count flat ingredients. Then, we obtained co-occurrence frequency between ingredients and classifiers in ingredient area in recipe pages by the pattern matching. Accuracy of this technique was about 82% in our preliminary experiment. The attributes about the presence of component elements such as seed, peel, core are determined by discovering sentences which suggest that a certain ingredient has the component element by pattern matching. For instance,“ seed of (ingredient) ”and“ (ingredient) whose seed is removed ” imply that the ingredient has seed. The patterns that match sentences like these are manually made. If an ingredient matched frequently with these patterns, we assumed that it has seed. Accuracy of this technique was about 57% in our preliminary experiment. Finally, when we try to determine attributes of 3550 ingredients extracted from the recipe corpus, sort of ingredients are determined for 2141 ingredients, shape of ingredient for 294 ingredients, presence of seed, peel, and core for 51, 150, and 18 ingredients, respectively.