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Generation of Animations
for Actions in Cooking Recipes

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In this research,we aim at the construction of the cooking operation instruction system that supports the understanding of the cooking technical term of an inexperienced user to cooking by assuming the action expression of the cooking recipe to be an input, and presenting animation that reproduces it. Karlin and Uematsu et al. did the research that generated animation from the recipe, however, these researches don't refer the problem of the scalability what percentage of the expressions in the cooking recipe can be converted into animations. Its attention was paid to the expression of action in a cooking recipe in this research ,and construction of the system which generates animation from each expression of action was aimed. Especially, we aim at the construction of a comparatively large-scale system that can handle a variety of action expressions that appear to cooking recipes.

The knowledge for converting into suitable animation an expression of action which appears in a cooking recipe is required for construction of a cooking animation generation system. In this research, the lexicon of cooking actions is constructed as knowledge to convert the operation expression into animation. Lexicon of cooking actions is a set of basic action in cooking, and knowledge necessary for animation generation is described for each action. When animation is generated, one entry(basic cooking action) of

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a suitable lexicon of cooking actions is chosen to an input expression of action, and animation is generated.

In order to build a lexicon of cooking actions , the definition was given as basic action which describes cooking action currently first introduced to the instruction book of the cooking marketed in a lexicon. Consequently, 265 basic actions were registered into the lexicon. The evaluation experiment was conducted in order that these basic actions might investigate how much cooking action which appears in a cooking recipe is included. Consequently, it wasn't contained in the lexicon of cooking actions about 42% among expression of action which is the candidates for animation generation in a cooking recipe, we turns out that it becomes alleged "unknown action". That is, it turns out that many of expression of action in a cooking recipe cannot generate animation. When the action expression not included in the lexion is analyzed, it turns out that there are a lot of general verbs such as "Cut it" and "Put it". Such a general verb is an important expression of action which occurs frequently to a cooking recipe, however, since it was rare to be explained to a cooking instruction book, it wasn't contained in the lexicon of action. Therefore, this problem was solved by adding the verb which occurs frequently in a cooking recipe corpus as basic action. Consequently, 32 basic cooking actions increased and were set to 297. The evaluation experiment of the lexicon of cooking actions after a basic cooking action addition was conducted. It turns out that 92.6% of an expression of action which is a candidate for animation generation in a cooking recipe deals with basic action of a lexicon of cooking action. The above-mentioned result, it became clear that the constructed lexicon of action includes many expression of action which appears in a cooking recipe.

Next, the module which searches for and extracts suitable basic action in a lexicon of cooking actions from an expression of action inputted from the cooking recipe called "matching module" was constructed. Animation is generated from basic action chosen by this matching module, therefore, a matching module has an important role for comverting an expression of action to animation. However, an expression of a cooking recipe of action has various surface expression, therefore, an expression of a cooking recipe of action and surface expression of basic action cannot choose suitable basic action in many cases only by simple comparison.The half of the

expressions of a cooking recipe of action is expressed with a different language expression from surface expression of basic cooking action indicated by the lexicon. Therefore, the difference in surface expression of a recipe and a lexicon was analyzed and flexible matching based on the analysis was performed. And, the matching module conducted the evaluation experiment which investigates the percentage which chooses suitable basic action. Consequently, about 87% of expression of action, the correct answer was included in selected basic actions. Moreover, only suitable basic action has been chosen about 63%.

Next, animation is generated based on basic cooking action chosen in the matching module. The concrete motion (action plan) of animation was described in 80 basic actions in a lexicon. Moreover, "animation generation module" which interprets a action plan and generates suitable animation was implemented, and we checked that suitable animation was generable about 80 basic actions which described the action plan.

A future typical works is described as follows. First, action plan should be described for all basic actions.Second, the matching algorithm of the expression of action in a matching module should be improved. Finally, each module is combined and "cooking animation generation system" is completed.