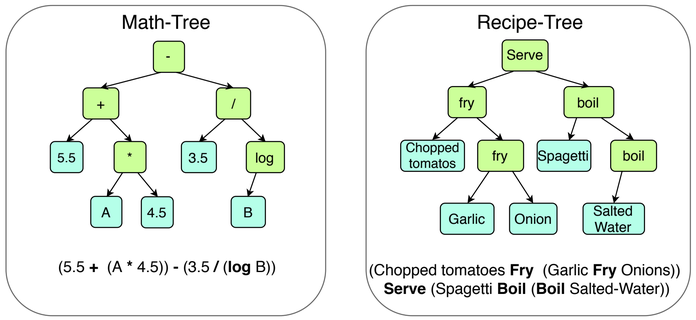
Smart Chef - Evolving Recipes

Carsten Draschner, Hajira Jabeen, Jens Lehmann

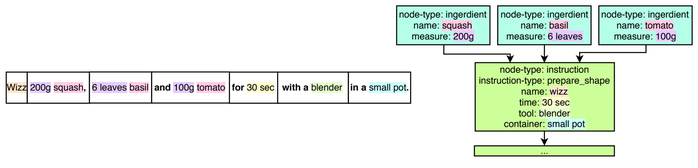
Machine Readable Recipes

- Semantics preserving Recipes Represenatation
- Recipe Representation inspired by Genetic Programming
- Variables correspond to **Ingredients**
- Mathematical Operations correspond to **Preparation Tasks**
- Operation Ordering given by Tree Structure

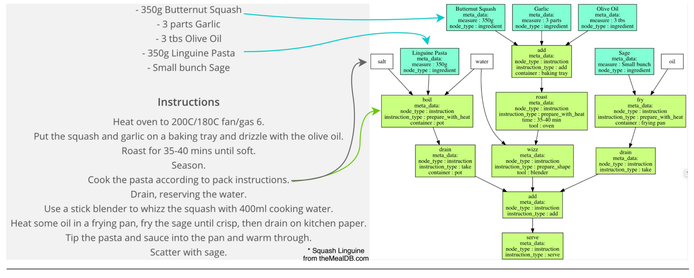


Example Preparation Task to Tree Representation

- Nodes have further Annotations containing Semantic Informations
- Ingredient-Proportions, Cooking-Time, Cooking-Tool, Cooking-Time, Preparation-Type (Heating, Changing Shape)

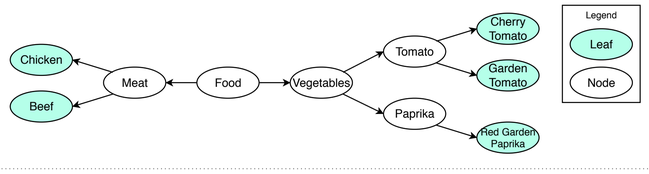


Complete Recipe Instructions to Tree Representation



Simplified Example Ingredients-Hierarchy-Graph

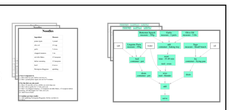
- Ingredients assigned a Hierchical Food Category Path



EA Recipe Creation

Initialization of Recipe Population

- Preprocessed Recipe-Instruction-Trees
- Recipes from around the World



Fitness Evaluation of Recipe Fitness

- Fully Automated Fitness Evaluation
- Multiple Criteria: Ingredient Composition, Fulfilled Ingredient Preferences, Recipe Validity Evaluation based on Comparison to valid Recipes

Final State?

- max Cycles Reached? If Yes --> Postprocessing

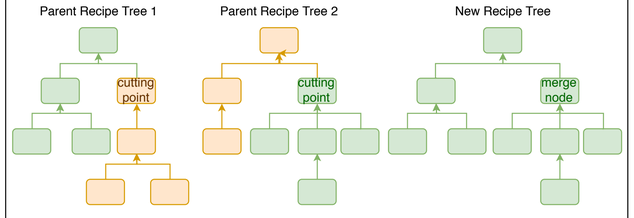
No

External Selection Recipe Survivors

- Based on evaluated Recipe Fitness Value

Recombination of Recipe Trees

- Merging two surviving Recipe Trees to generate novel Recipe
- One random Subtree is exchanged by a different Subtree



Mutation of Ingredients

- Each novel recipe mutates one Ingredient
- The exchange probability to all ingredients is dependent on the food similarity given by hierarchy, i.e. for Garden Tomato

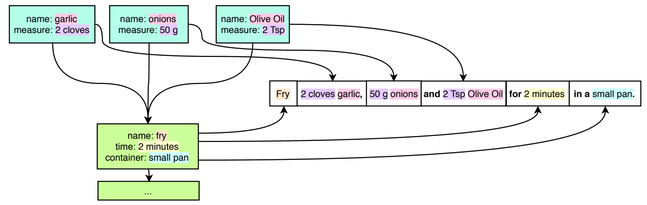
ingredient	path	distance	probability
Cherry Tomato	Food - Vegetables - Tomato	0	73%
Red Garden Paprika	Food - Vegetables - Tomato	2	18%
Chicken	Food - Meat	3	4.5%
Beef	Food - Meat	3	4.5%

Example substitution probabilities based on simplified example Ingredients-Hierarchy-Graph (left)

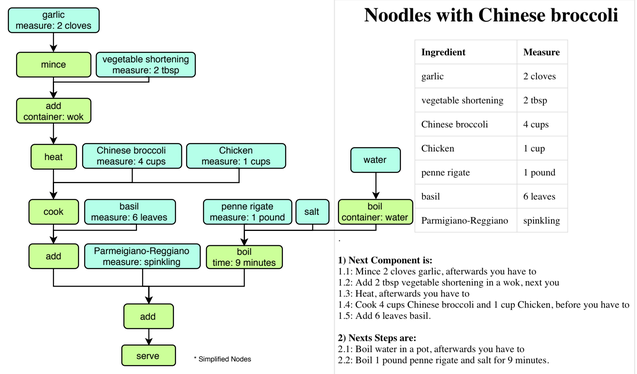
Natural Recipe Generation

- Evolutionary Algorithm creates Instruction Trees representing novel creative Recipes
- A Postprocessing generates natural Human Readable Recipes from the generated Instruction Trees
- Postprocessing is fully automated
- Sentence Order corresponds to inverted Deep Search
- Paragraphs results from Merging Instruction Nodes

Small Example for Nodes To Human Readable Sentence



Complete Postprocessed Recipe



References

1. Recipes: theMealDB.com JSON API
2. Ingredient Sources for Classification: foodb.ca, foodsubs.com
3. Poster Created With draw.io

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