Smart Chef - Evolving Recipes

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Machine Readable Recipes
- Semantics preserving Recipes Representation
- 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

Simplified Example Ingredients-Hierarchy-Graph
- Ingredients assigned a Hierarchical Food Category Path

Complete Recipe Instructions to Tree Representation
- Each recipe is represented as a tree structure
- Nodes correspond to ingredients, preparation type, cooking time, etc.
- Edges represent relationships between ingredients

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
- 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

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
- Example substitution probabilities based on simplified Ingredients-Hierarchy-Graph

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