Why Aren't We Cooking AI Recipes? A Review Paper

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1 Introduction

- Eating is a fundamental cultural element
- Recipes capture processes to produce a dish
- Recipes are embed with cultural meaning
- Over the past two decades we have been increasingly sharing what we eat and cook on the Internet
  - Videos on Platforms
  - Recipes on Sharing Websites
  - Pictures on Social Media
- Data for AI studies and applications by academics, start-ups, and large companies that **analyze, classify, modify**, and **create** the way we produce and consume food, including recipes

2 Research Question

Why Aren't We Cooking AI Recipes?

3 Methods

- Literature Review. Keywords: "food recipes", "computational creativity systems food", "flavor network", "food pairings", "food net-works", and "computational gastronomy" on Google Scholar, Ebsco Host, ProQuest, and ArXiV
- Abstracts checked to find other sources
- Resulting documents evaluated for topic relevance
- N documents: 103, Final Set after evaluation: 79
- Content analysis and classification

4 Results and Discussion

4.1 Analysis of Recipes

- Recipes used as sources of information to understand food and culture for over 50 years in the Social Sciences
- Late 2000's quantitative studies from Computer Science and Physics started to gain traction
- Network science to explain ingredient pairings based on the chemical composition of ingredients which produce food aromas
- Recipe recommendation and recipe retrieval systems for website users
- Improve identification and classification of cuisines
- Recipe evolution over time
- Emphasis on chemical compound pairings leaves out multisensorial experience (no studies on sound, food consistency, sight, plating, and even taste! (saltiness, sweetness, ...)etc) $\rightarrow$ Hierarchy of the senses
- Data representativity: Datasets biased, most of the recipes are uploaded by users who have internet connections. Language, wealth, age, computer literacy, geographies with limited internet access, etc. Almost no African and Latin American recipes
- Data processing problems: defining and standardizing units of analysis
- Lack of data i.e. Chemical volatile compounds $\rightarrow$ Contradictory findings
- Data ownership ethics: users upload recipes, companies use and market the information, sometimes pull out recipes if they go bankrupt. Initiatives such as openrecipes seek to claim back some ownership by partially scraping user generated websites were born out of this problem

4.2 Computational Gastronomy

- Computational gastronomy proposes a change in the way in which recipes are produced as it uses AI to aid chefs and recipe authors in their creative endeavors, usually through HCI interphases.
- Modify or help creating existing recipes
- Some applications include: Producing healthier, using sustainable ingredients, catering to certain dietary restrictions, aiding chefs in discovering novel flavors.
- HCI in Computational gastronomy uses insights from large-scale analysis of recipes. Recipe creators can gain an edge in their creative endeavors using these technologies
- HCI: Chef + machine: Cultural and situational awareness, think type of cuisine, religious restrictions, etc. Chef makes sure that AI's output is ethical and adapts to cultural norms.
- recipe creator ensures that recipes they are serving to clients are appropriate for the décor of the restaurant, music, re-views, as the client expects and anticipate a particular product from that restaurant
- recipe creator's domain knowledge
- Growing adoption among chefs. examples: whisk, foodpairing
- Ethics and biases arise from datasets used
- Dataset biases: new ingredients (natural now trending (think kale, quinoa, ube), or newly developed (impossible burger, CBD, etc)), ethnic ingredients

4.3 Computational Creativity Systems

- AI's computational creativity systems impressive ability to leverage data analytics combining an array of datapoints in recipes along with external information such as ratings, ingredient networks, chefs who test the recipes, and humans who asses them.
- Promising findings and developments that encompass ingredient selection, preparation techniques, cooking times, etc.
- Applications with varied aims from creating ingredient lists in recipes to creating a complete recipe from scratch
- Lack of a situational and domain knowledge awareness: Low adoption and mockery on social media
- Builds on previous systems database biases and limitations
- Culturally inappropriate recipes: Not linked to any cuisine, history, tradition, food discourse
- Lackluster results: IBM's Cooking with Watson is now offline. No other initiatives are online to my knowledge. In contrast with Computational gastronomy solutions.
- Changes in the field make getting recipe datasets harder (Yummly's researcher API shutdown October 209) it is possible that the field moves into more private domains $\rightarrow$ fewer transparency regarding dataset biases and representativity

5 Limitations

- Review paper, hence no hands on analysis such as interviews or surveys has been carried out
- Some of the algorithms and implementations powering these systems are not published hence it is hard to grasp how they work

6 Conclusion

- Three major topics were found in the literature review: Analysis of Recipes, Computational Gastronomy, Computational Creativity Systems
- Biased datasets in many respects: geography, language, age groups, users
- Lack of data and real time data needed to glimpse new new trends
- Recipes created by computers may not be accepted by consumers who embed food with cultural, social, geographical, sensorial, and affective meaning
- Biases towards chemical compound pairings (olfactory-taste), no incorporation of multisensorial elements such as sight, sound, etc.
- HCI systems in which chefs are responsible for bringing cultural awareness, domain expertise, and locate the food in a time and geographical setting seem to be leading the way
- Computational creativity systems of food recipes have been pulled out while HCI applications are still in business
- Ethical considerations arising from datasets used, cultural, religious and other aspects need to be considered
- Data ownership and intellectual property problems arising from users transfer of ownership may represent a threat
- It is advisable to include rules that account for culturally appropriate recipe recommendations (religious observances, cultural preferences, etc.)
- Collaboration with underrepresented communities in a way that ensures they own their data may be a good idea to ensure that recipes in all domains of AI of recipes are less biased and possibly received better

7 Future Work

- Researching the differences between human created recipes and HCI or AI created recipes perhaps using network science may be lead to a better understanding of the differences between the two types of recipes and hint towards its lack of adoption
- Sentiment analysis or content analysis studies that look at the reception of these technologies may offer further information that strengthens the findings of this review
- Surveys or focus groups could further the findings of this work by talking to users and developers who have tried and/or are involved in creating these applications

THANK YOU

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