

A photograph of a white ceramic cup filled with dark coffee, sitting on a matching saucer. The cup and saucer are placed on a dark, textured wooden surface. A large, irregular green brushstroke is painted over the left side of the image, partially covering the cup and the text.

# Food Computing

## *How Far Have I/We Come?*

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## **AGENDA:**

- *FOOD COMPUTING: AN EMERGING FIELD*
- *FOCUS AREAS: SOCIAL MEDIA + RECIPE ANALYSIS*
- *PUBLICATIONS + UPCOMING PUBLICATION*
- *FUTURE RESEARCH*
- *CHALLENGES AND CONSIDERATIONS*

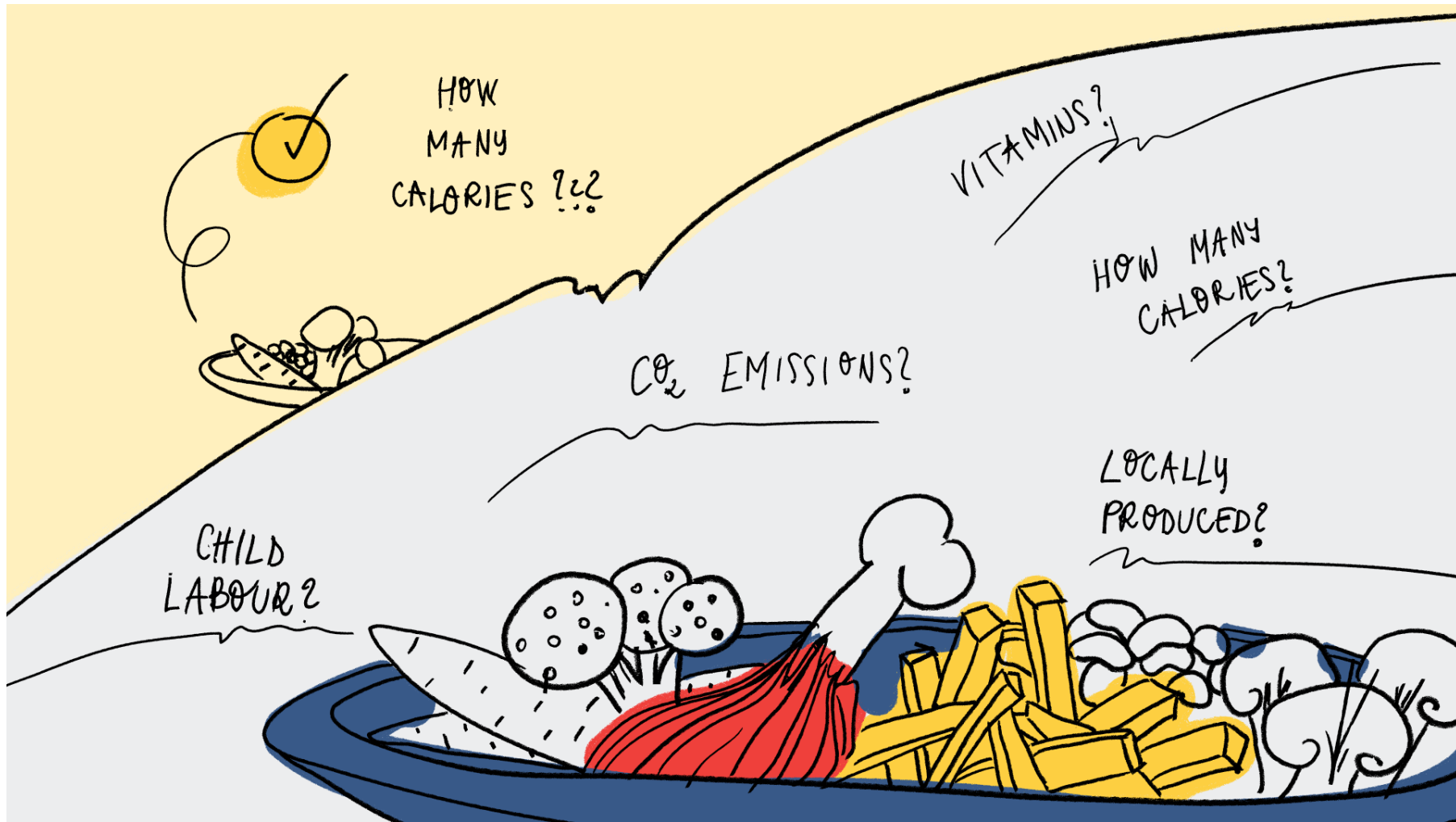
## **KEYWORDS:**

BIGRAM, WORD ASSOCIATION, FOOD BLOG, SOCIAL MEDIA, FOOD COMPUTING, COMPLEXITY, HEDONISM, KNOWLEDGE GRAPHS, TOPIC MODELLING

# *Context*

- The changing nature of humans from hunter-gatherers to 'super-consumers'
- Lifestyle-induced obesity, Type 2 diabetes and cardiovascular diseases are on the rise, leaving public health policy makers with little success
- Food choice is highly contextual: accessibility, cultural background and habits all play heavier or lighter roles in food-related decisions
- Digital food-related hedonism growing: multitude of food images on Instagram, the art of plating and poetic descriptions
- Corrective aspects of human and food relationships are better documented

# *The New Reality*



Illustrator: Liene Lesina/ NORDEN.LV

# ***Cross Sectorial Challenges***

Computing science researchers' focus on:

- Taste (food pairings, allergens replacement)
- Number of ingredients (nutritional information)
- Recent focus on recipes as knowledge graphs

Cognitive science researchers' focus on:

- 'Everything else, except taste'
- Rise of multisensory research (colour+texture+taste+context)
- Social background (e.g. High-end restaurants, menu wording)

# ***Major Challenges***

- What are the right questions to ask when doing research?
- How to overcome cross-sectorial research challenges?
- What is the current state of art and where should we move on?
- My research focus: ***how can we utilize the data available in order to move towards more healthy diets and, consequently, to a higher life quality?***

# 3 Articles

- Presented during **DHN2020** (Digital Humanities in the Nordic countries was formed in Oslo, April 21, 2015. The purpose of the organization is to strengthen research, education and communication in the field of Digital Humanities)
- Here is the **video** presentation:  
[https://www.loom.com/share/74788743ea66468eaefb8b79a5d202ed?sharedAppSource=personal\\_library](https://www.loom.com/share/74788743ea66468eaefb8b79a5d202ed?sharedAppSource=personal_library)
- **Proceedings** of the Digital Humanities in the Nordic Countries 5th Conference, Riga, Latvia, October 21-23, 2020, <http://ceur-ws.org/Vol-2612/>

## Tracing Complexity in Food Blogging Entries

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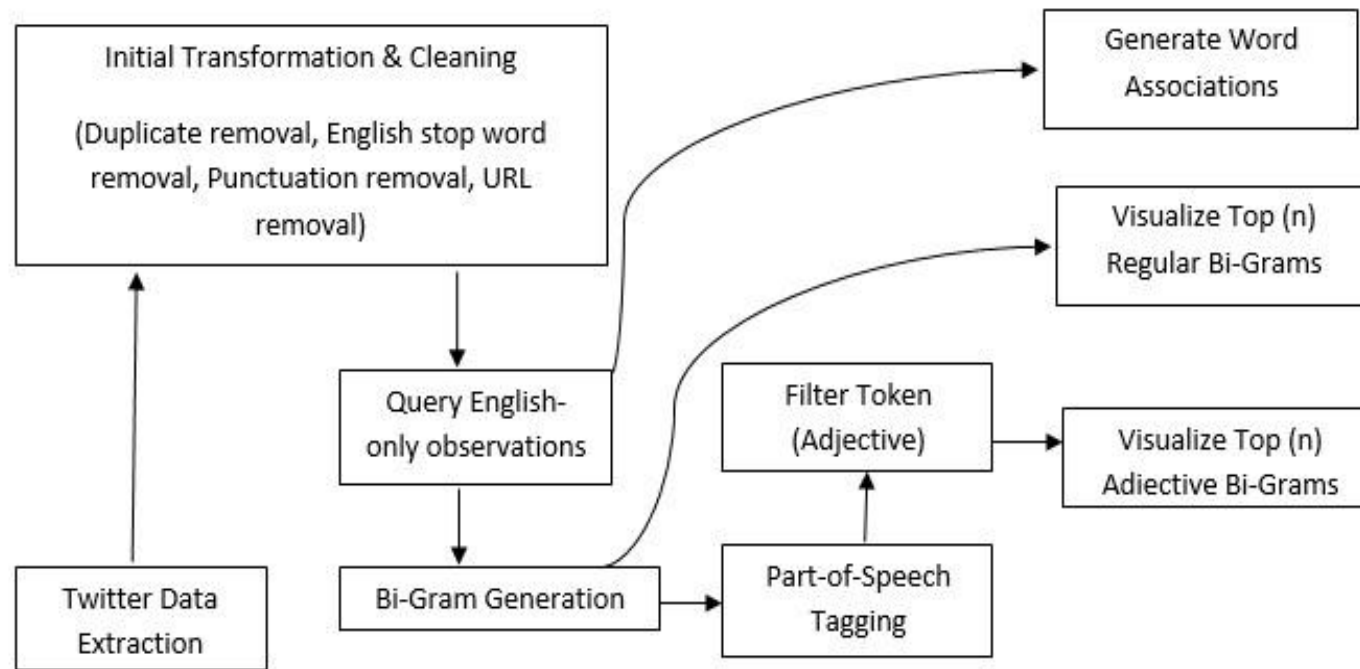
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**Abstract.** Within this paper, we focus on the concept of complexity and how it is represented in food blogging entries on Twitter. We turn specific attention to complexity capture when looking at healthy foods, focusing on food blogging entries that entail the notions of health/healthiness/healthy. We do so because we consider that complexity manifests hedonism - that is the irrational determinant of food choice above rational considerations of nutrition and healthiness. Using text as a platform for our analysis, we derive bigrams and topic models that illustrate the frequencies of words and bi-grams, thus, pointing our attention to current discourse in food blogging entries on Twitter. The results show that, contrary to complexity, that the dominating characteristics in healthy food domain are easiness and speed of preparation, however, rational and health related considerations may not always take precedence when the choice is determined. Food blogging entries show surprisingly little account of healthy food as being tasty and enjoyable. With this we aim to contribute to the knowledge of how to shape more healthy consumer behaviors. Having discovered the scarcity of hedonic connotations, this work invites for further research in text-based information about food.

**Keywords:** Bigram, Word Association, Food Blog, Social Media, Food Computing, Complexity, Hedonism.



# ***Research Methodology and Knowledge Extraction Procedure***



- Text mining
- Keyword searches were made for posts in English language on the following topics: '#healthyfood' and '#recipeoftheday'
- 28 509 observations were obtained consisting of posts made between late December 2019 and early January 2020
- We sought to find out associations of words such as:
  - (1) "healthyfood" and "healthy" supported by terms such as "sustainable", "nutritious", and "tasty"
  - (2) "vegan" and "vegetarian" supported by terms such as "lowfat", "healthy" and "tasty"
- When referring to blog entries on Twitter within the context of this research, we are referring to **one-tweet-long micro-blog entries**; longer texts that exceed the standard length of a tweet might lead to different results



# ***Results and Conclusions***

- With this research, we aimed to prepare the basis for enhancing consumption of healthy foods.
- Having made an analysis of the level of complexity of texts describing food, we have ascertained the lack of hedonism-denoting terms in healthy food descriptions.
- We did this by looking at the complexity as a necessary precondition for a hedonic food experience, viewing the complexity of food from the point of view of its ingredients, preparation and flavor experience, the latter of which potentially expresses the hard-to-define concept of complexity most fully.
- By using the technique of word associations, we first did a bigram analysis and then examined two word-association extractions in order to determine what the word combination “healthy food” is usually accompanied with.
- It turns out that this word combination tends to go together with the words denoting rational choice and very few words that would signify pure pleasure of consuming the food.
- With this we conclude that the current food blog entries of Twitter tweet length related to healthy food do not focus on taste aspects and contain few references to hedonic expressions, focusing rather on “simple and easy” and less so, or almost not at all, on “complex and enjoyable”.
- Lastly, this research also contributes to the discussion on the extent to which concepts that are used in cognitive science domain are operational in the quantitative analysis of texts.

# 3 Articles

- DHN2020 post-proceedings: the opportunity to publish the papers is given to all presenting authors.
- Accepted papers will be submitted to the [CEUR-WS proceedings series](#) for publication. This is a free open-access publication service at Sun SITE Central Europe operated under the umbrella of RWTH Aachen University.
- CEUR-WS.org is a recognized ISSN publication series, ISSN 1613-0073. The proceedings are indexed in the Scopus database.

## Healthy Food Depiction on Social Media: The Case of Kale on Twitter

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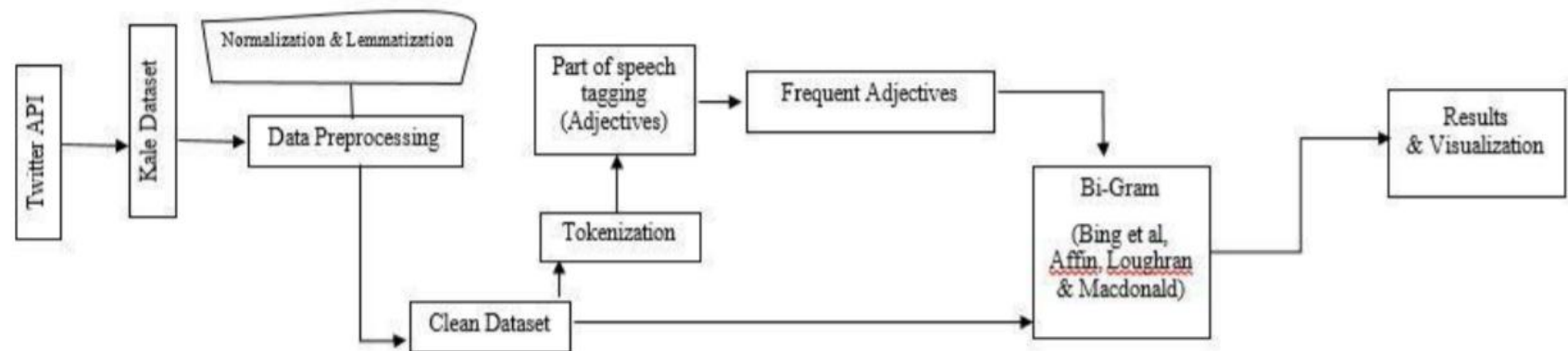
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**Abstract.** This article aims to contribute to the food computing field by analyzing Twitter microblog entries related to food. A particular attention here is paid to one specific healthy food - kale. Such an approach is chosen due to kale's popularity as a healthy food. By applying sentiment measurement, authors aim to contribute to the understanding of text-based stories behind healthy food, and conclude that kale offers clear benefits for consumers via its specific health-related aspects (anti-inflammatory, immune system boosting, etc.) while taste is being left outside the discourse. The lack of any references to taste in kale-related social media stories leads to the conclusion that healthy food descriptions in general are short of hedonistic manifestations. Subsequently, this can be seen as one of the drawbacks of healthy food presentation textually vis-a-vis comfort foods. With this study we aim to contribute to the knowledge of the most efficient methods in shaping healthier consumer behaviors and inspire for further research of text-based information related to food.

**Keywords:** Food Computing, Kale, Sentiment-Token Bigram, NLP, Health, Taste, Word Association, Food Blog, Social Media, Hedonism

# Research Methodology and Knowledge Extraction Procedure



**Table 1.** Algorithm for Sentiment-Token Bigram

Algorithm: Sentiment-Token Bigram
Data: Twitter Posts Dataset (N observations)
Sentiment Lexicon: Dictionary of terms associated with sentiments
Result: Bigram with a Sentiment Lexicon Term as the first word
load SentimentLexicon
for each observation do
extract LexiconTerm and SubsequentToken
repeat until no observations left
end
count bigrams
delete bigrams with low frequency (user-defined threshold)

# ***Results and Conclusions***

- We concluded that the notions of hedonism and tastiness are left outside the sentiments associated with consuming the healthy food kale.
- Though it may not have adversely influenced the result of the analysis, a minor limitation of the study was the lack of a wider scope of dataset from previous years (i.e. before 2020).
- The study's theoretical contribution is evident in the introduction of a novel Sentiment-Token Bigram algorithm which could be applied in the computational linguistics.
- Lastly, this research also contributes to the discussion of the extent to which concepts that are used in cognitive science domain are operational in the quantitative analysis of texts. Due to the challenge of cross-sectionality, this research has aimed to refine the questions that could be posed by the research community with regard to food and human relationships. Potentially, instead of asking 'how tasty the food is?' we should rather ask: 'how interesting or entertaining the food is?' or 'to what extent food consumption is related to social status?'
- Instead of narrowing down the focus on taste, as has been customary in computing science to date, the focus should be broadened and encompass e.g. food's associations with entertainment, sensuality and hedonism, as well as its ability to elevate one's social status or manifest other important identity markers. The growing research of food computing which raises cross-sectionally relevant questions brings us ever closer to understanding the phenomenon of the food choice.

# 3 Articles



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## Utility of Large-Scale Recipe Data in Food Computing

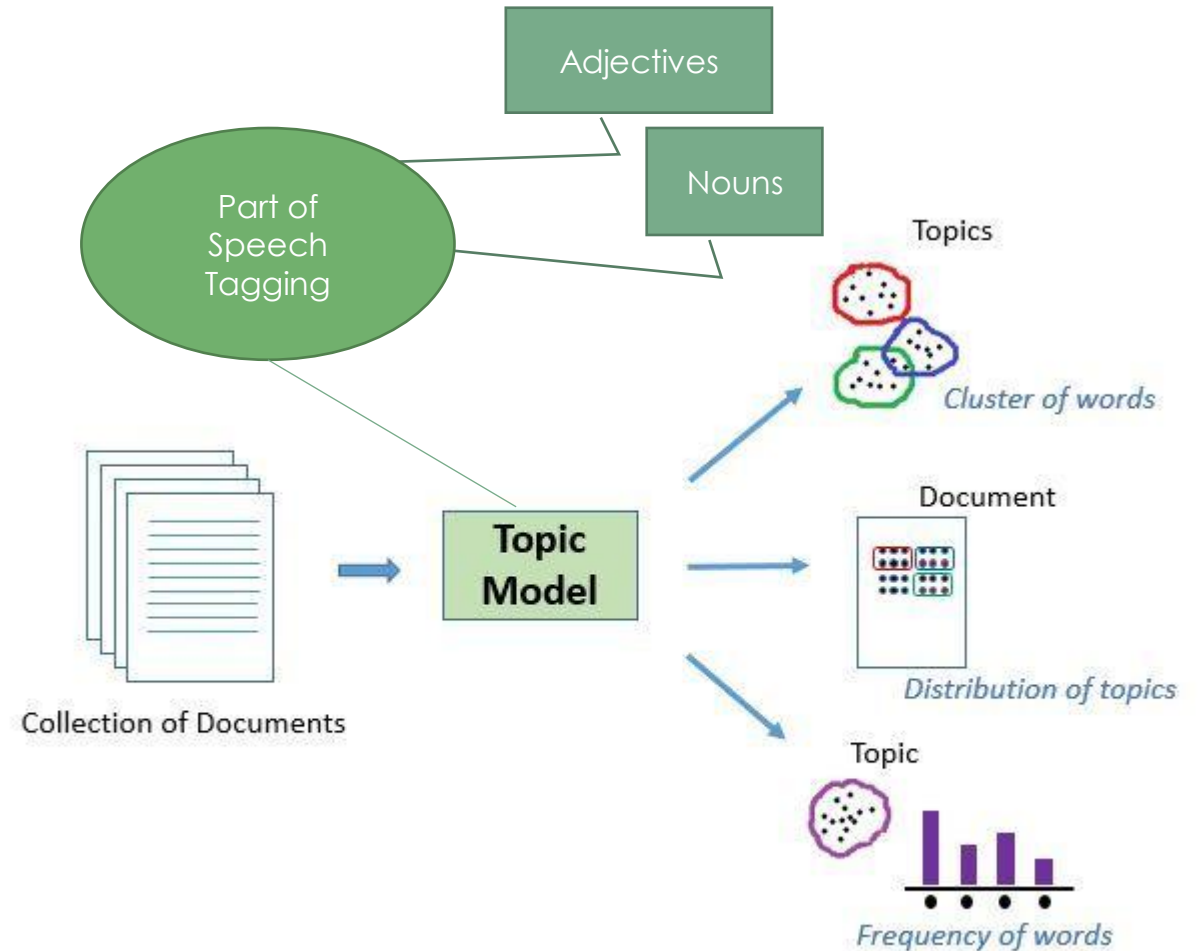
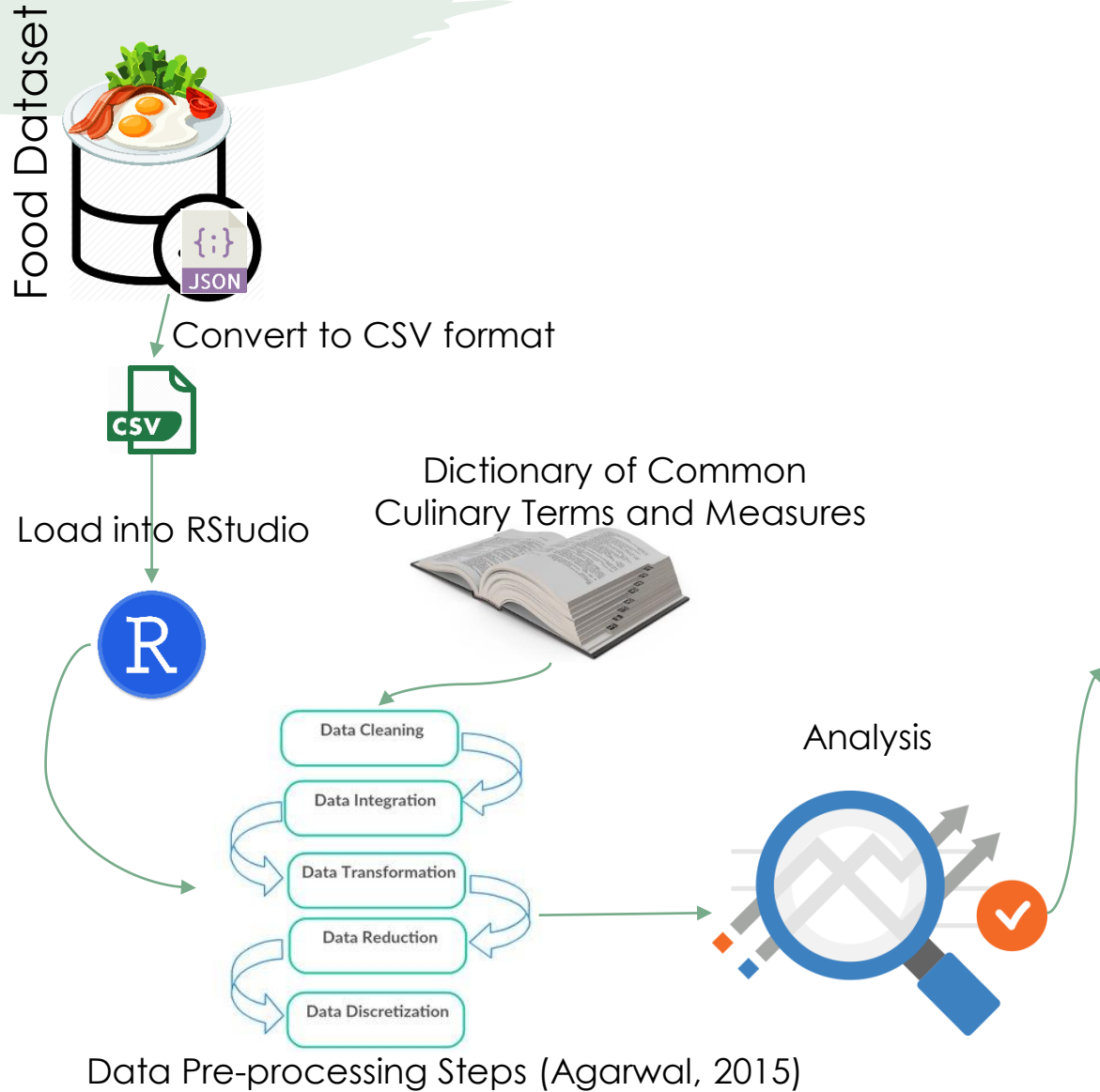
### Abstract

This article aims to look at the recipe data analysis from a critical perspective, offering the authors' own learning experience from successes and failures of the research process. The present recipe research has been limited by the availability of data, which in the case of recipes mostly consists of texts depicting a variety of ingredients. This has contributed to a better understanding of flavour formation and nutritional value of food but has not led further to establishing a corpus of healthy and unhealthy foods. Time-related cooking aspects have remained largely out of the present research's scope due to the difficulties in obtaining immediately analyzable data. The same goes for the recipe-relate research on food texture, color and other aspects. In this research the methodology of topic modeling has been applied to analyze recipes in North American and Mexican cuisines. Potential for result analysis, as well as its limitations, are also discussed. Topic models of agglomerated data can be helpful in further multisensory research, as they provide some insights into the colour, the flavour and, potentially, the texture of certain groups of dishes. It can be combined further on with social media sentiment analysis and other research methods to better grasp the human relationship with food.

**Keywords:** Food Computing, Recipes, Topic Modelling, NLP, Healthy Food, Multisensory Research



# ***Research Methodology and Knowledge Extraction Procedure***



Context-Based  
Topic Modelling Process adopted from Akwei (2019)

# ***Results and Conclusions***

- To conclude, large-scale recipe data analysis does provide certain but limited understanding of the human relationship with food.
- There is a potential for large-scale recipe data to be used in combination with additional classification of ingredients (e.g. 10 Kāle and Agbozo according to texture, timeline and food preparation), social media analysis (determining search inquiries for food representation and sentiments associated with it) and actual consumption habits (e.g. which meals are prepared at home and which are based on readymade produce).
- Social media analysis is still underused when it comes to food and large-scale recipe data, however, it can be useful in combination with food-related social media data. Thus, for example, insight into recipe ingredients can help form a better understanding of which hashtags should be used for social media search inquiries. Based on recipe data, one can choose the most used ingredients to search for social media response, followed by the social media sentiment analysis.
- While large-scale recipe data can provide a certain added value for food computing researchers, the assumptions used for analysing human relationship with food must be constantly refined, lest the oversimplified views on the importance of flavour and palatability become entrenched. The field of food computing is rich and promising. The new emerging methodologies for analysing text- and image-based food data can advance into personalized food models, ultimately condensing the data for a targeted benefit of an individual's health

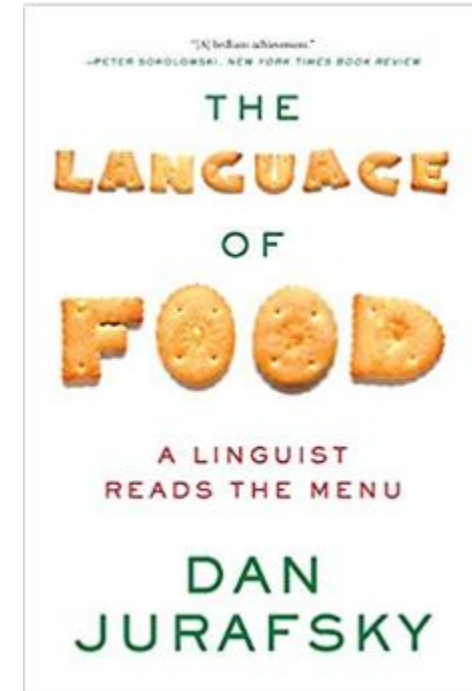


## ***Current work in progress***

- Recipes as knowledge graphs: collaboration with Prof. Ramesh Jain & others
- Multisensory collocations in Twitter tweets (10 years Latvian language corpus) with Dr Matīss Rikters & Prof Jurgis Šķilters
- Tasty vs Healthy dilemma together with Prof. Laila Meija (RSU)

# *Food for Thought*

- Only from 1800s the word “love” was used to describe inanimate objects like food
- Negative > Positive
  - Few vague positive words – *amazing, perfect, wonderful, fantastic, awesome, incredible, great* – regardless of whether they were rating taste, smell, feel or look
  - Negative differentiation – more adjectives to describe pain than pleasure. More vocabulary to describe people we dislike than people we like
  - «Happy families are all alike; every unhappy family is unhappy in its own way.» Lev Tolstoy, Anna Karenina



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