SENIOR RESEARCH
CSC 450

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Course website: https://gdancik.github.io

Example #1: factorial method

```
// precondition: a non-negative integer (n) is ready to be specified
// postcondition: returns n! = n*(n-1)*(n-2)*...*1, with 0! = 1.
public static int factorial(int n) {
        int prod = 1;
        for (int i = n; i>1; i--) {
                prod *= i;
        }
        return prod;
}
```

- Can we *prove* that this method is *correct*?
- What if the method is called with a negative number?
- What if the method is called with a very large number? How *reliable* is the method?

Example #2: factorial method (recursive)

```
// precondition: a non-negative integer (n) is ready to be specified
// postcondition: returns n! = n*(n-1)*(n-2)*...*1, with 0! = 1.
public static int factorial(int n) {
        if (n == 0) return 1;
        int prod = n * factorial(n-1);
        return prod;
}
```

- Is this method *better* or *worse* than the *factorial* function on the previous page?
- How could we compare the two methods?

Paradigms in Computer Science

- Rationalist paradigm – programs are mathematical objects
  - Ex: we can theoretically *prove* a program is correct, will not crash, etc.
- Technocratic paradigm - we can empirically determine reliability through testing
  - Ex: program crashes 0.00001% of the time
- Scientific paradigm – programs are like natural processes and are amenable to experiment and study
  - Ex: Evaluate which sorting method is better, among 2 or more
  - Ex: Evaluate different ways of limiting the spread of COVID-19 using a computer model of COVID-19 transmission (https://eida.easternct.edu/EpiModel-COVID-ECSU.html)
  - Ex: Evaluate which is ”better” -- Alexa, Google Assistant, or Siri (https://www.ibtimes.com/alexa-vs-google-assistant-vs-siri-googles-voice-assistant-has-higher-iq-2815141)

What is scientific research?

- Scientific research means a systematic investigation, including research development, testing, data collection and evaluation, designed to develop or contribute to generalizable knowledge (modified from National Science Foundation)

- Let's look at an example:
  - https://dl-acm-org.ecsu.idm.oclc.org/citation.cfm?id=3233186

  - What is the problem the authors are addressing?
  - What is the claim that the authors make?
  - What evidence do the authors have that supports their claim?

Food/Non-food Image Classification and Food Categorization using Pre-Trained GoogLeNet Model

Recent past has seen a lot of developments in the field of image-based dietary assessment. Food image classification and recognition are crucial steps for dietary assessment. In the last couple of years, advancements in the deep learning and convolutional neural networks proved to be a boon for the image classification and recognition tasks, specifically for food recognition because of the wide variety of food items. In this paper, we report experiments on food/non-food classification and food recognition using a GoogLeNet model based on deep convolutional neural network. The experiments were conducted on two image datasets created by our own, where the images were collected from existing image datasets, social media, and imaging devices such as smart phone and wearable cameras. Experimental results show a high accuracy of 99.2% on the food/non-food classification and 83.6% on the food category recognition.

Background
Significance
Methods
Results
Conclusion

[1]A. Singla, L. Yuan, and T. Ebrahimi, “Food/Non-food Image Classification and Food Categorization using Pre-Trained GoogLeNet Model,” Proceedings of the 2nd International Workshop on Multimedia Assisted Dietary Management. ACM, Oct. 16, 2016. doi: 10.1145/2986035.2986039. https://dl-acm-org.ecsu.idm.oclc.org/doi/10.1145/2986035.2986039

Course Objectives

1. Demonstrate the ability to engage in independent inquiry
2. Apply current and critical thinking in a focused area of study
3. Reflect on the context of the independent inquiry or artistic creation
4. Reflect on this work as an outcome of a liberal arts education
5. Learn to write, communicate, and present research ideas and results in computer science.