Research & Technical Presentation
Assignment 2

Ali Gholami

Department of Computer Engineering & Information Technology
Amirkabir University of Technology

http://ceit.aut.ac.ir/~aligholamee
aghce@aut.ac.ir

Abstract

This assignment reviews the different types of research. We'll give an example for each type of research. We'll also study the usage of *fish-bone* diagram as a conceptual framework. We'll focus on the *mind-map* and draw that for a particular point.

Assignment 2 key words. *Theoretical Research, Practical Research, Incremental Research, Conceptual Framework, Mind Map, Computer Engineering, Software Engineering.*

Practical Problems

1. An Illustration of Research in Computer Engineering

Provide examples for the different methods of research in computer engineering. These examples must cover all types of research in computer engineering including: **Theoretical** *Research,* **Practical** *Research and* **Incremental** *Research.*

Solution

Firstly, we'll review the different methods of research in science & engineering. Then we'll exemplify each.

- **Theoretical Research** – In this type of research, the whole effort is made to expand the borders of pure science. Its important to mention that the focus is neither on the application of this science nor the quality of human life. The goal of this type of research is to provide the fundamentals of pure science.

- **Practical Research** – This type of research will make use of the explained *Theoretical Research* to improve the quality of human life. It also provides solutions to the existing complications. The goal of this type of research is to apply the science on the day-to-day life problems.

- **Incremental Research** – Incremental research looks for the usage of above techniques to implement them as a real-life product. The focus is to make use of the two mentioned techniques in the industries.

Some of the best examples of each of these research techniques are provided below. In my opinion, some of the best examples of theoretical research can be found on *Google Scholar* papers. For the practical examples, I've used the *Standford Machine Learning Projects Website* which I think is the best on its own. Finally, the examples of the incremental research is given from the *Google Brain* & *OpenAI* projects.

- **Theoretical Research Examples**

  1. ***Euclidean Jordan Algebra***
     - The Cauchy interlacing theorem in simple Euclidean Jordan algebras and some consequences. **[pdf]**

  2. ***Linear Matrix Equations***
     - Guaranteed Minimum-Rank Solutions of Linear Matrix Equations via Nuclear Norm Minimization. **[pdf]**

  3. ***Convex Optimization***
     - Distributed average consensus with least-mean-square deviation. **[pdf]**

- **Practical Research Examples**

  1. ***Computer Vision & Machine Perception***
     - Linear Pose Estimation from Points or Lines. **[pdf]**

  2. ***Automatic Speech Recognition***
     - Context-Dependent Pre-Trained Deep Neural Networks for Large-Vocabulary Speech Recognition. **[pdf]**

  3. ***Computational Linguistics***
     - Incorporating Non-local Information into Information Extraction Systems by Gibbs Sampling. **[pdf]**

- **Incremental Research Examples**

  1. ***Neural Machine Translation***
     - An Speech Recognition System for the Android Operating System. **[product]**

  2. ***Video Recommendation***
     - Deep Neural Networks for YouTube Recommendations. **[product]**

  3. ***Reinforcement Learning Application***
     - *OpenAI Gym* – A toolkit for developing and comparing reinforcement learning algorithms. **[product]**

2. A Mind-map of Computer Vision

Provide a mind-map for your desired subject. Make sure to bring details about the subject you choose.

Solution

I'll try to provide as much as details for the *Computer Vision* subject. I've chosen the *Computer Vision* for two main reasons:

- Computer Vision is the subject that makes me feel fresh every single day.

- Most of my time is spent of Machine Learning & Pattern Recognition concepts. These studies are inclined on the vision side. Working with image datasets and analyzing the statistical methods are good examples of this fact.