Master in Web Technologies and Systems Engineering

Research Methodologies

HOW TO WRITE A SCIENTIFIC PAPER

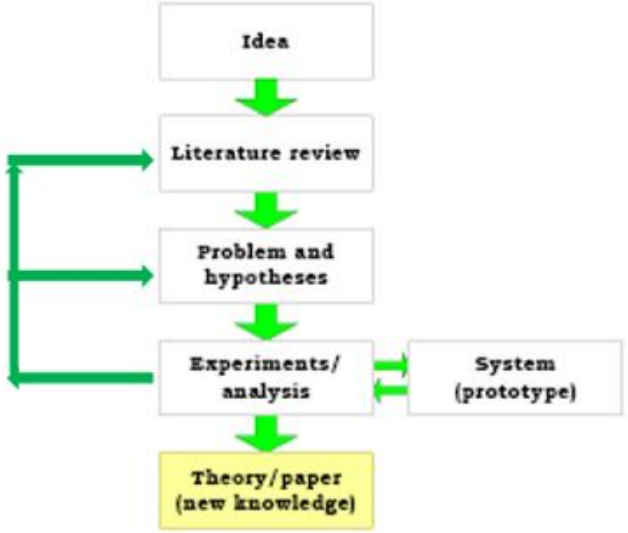
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MSR- Methodologies for Scientific Research

Selected Website on writing scientific papers:

Columbia University: http://www.columbia.edu/cu/biology/ug/research/paper.html

MSR- Methodologies for Scientific Research



Source: GETA and Graduate School of Electrical and Communications Engineering course: Introduction to Research Methodology, Helsinki University of Technology

A “common” Scientific document structure

Document structure: Sections

- Title
- Abstract
- Introduction
- Materials and Methods
- Results
- Discussion and Conclusion
- Bibliographic references

A “common” Scientific document structure

Document structure: TAKAR / IMRaD

Title, Authors, Affiliation
Abstract
Keywords

Introduction - What is the issue?
Material and Methods - How did you try to answer it?
Results - What did you find?
and
Discussion and Conclusion - What does it mean?

A “common” Scientific document structure

Document structure:

- Introduction
  - Providing the context
  - Aim of the study
- Method
  - Population, procedures/statistical analysis, etc.
  - Reproducible
- Results
  - Data (without interpretation)
- Discussion
  - Interpretation of data
  - Put in context with existing research
  - Limitations

A “common” Scientific document structure

Document structure:

Introduction

3 – 4 paragraphs

Method

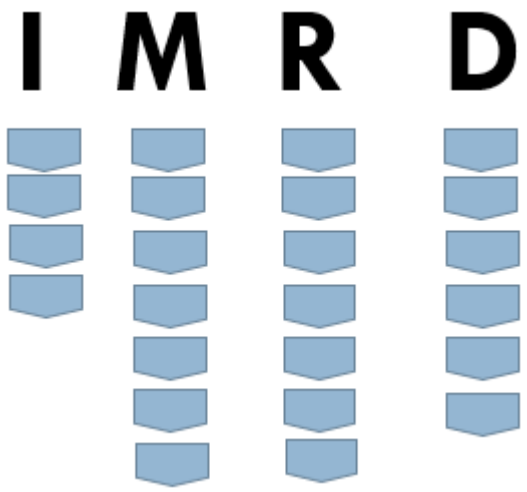
6 – 7 paragraphs

Results

6 – 7 paragraphs

Discussion

5 – 6 paragraphs



Scientific Research

BEFORE writing a paper:

- A scientific research paper should reflect the research method followed

- In the classical scientific method we may depict the following steps:
  - Observations (empirical, non-empirical)
  - Hypothesis setting to explain or answer those observations
  - Testing predictions searching for evidences about future observations (experimentations ➔new observations)
  - Test results interpretation
  - Accepting or rejecting Hypothesis

Scientific Research

In the scope of Computing and Information Systems:

- Requirements definitions
- Specification / Modelling
- Implementation (and/or simulation) - (Proof-of-concept)
- Evaluation
- Accepting, rejecting or go to the new spiral re-starting by Requirements

Paper Objectives

Conceptualization of a scientific paper:

Two main objectives in writing a paper :

- First, it must clearly and completely describe the procedures that were followed and the results that were obtained.
- Second, it must place these results in perspective by relating them to the existing state of knowledge and by interpreting their significance for future study.

MSR- Methodologies for Scientific Research

Literature review :

Implies the production of a written Report (or paper's chapter/section)

- well organized and including a comprehensive summary of the state of the art (current research perspectives and technology) with a clearly defined focus in a particular domain of knowledge.

- to obtain the most recent information it is required that you read the most recent journal articles and conference / Workshop proceedings and research projects descriptions

Paper Motivation

Choose the topic under investigation to be reported:

- What are the issues to be dealt with,
- Questions to be answered,
- Hypothesis to test?

- Related with permitted number of pages
  - Vague and open topic (or exhaustive Theme), may be for a book or a speculative article, but not for a 6-12 (or even 12-16) pp. research paper

Paper Preparation

Examples of issues to deal with:

1-“The use of autonomous agents for traffic control management”
2-“Program specification through Aspect Oriented Programming”

Examples of specific questions:

1-“How to organize a Multi-Agent System?”
“What the entities will be and which ones can be *agentified*?”
“Shall I use heterogeneous (mix different kinds of) Agents?”
“What kind of measurements are important to be measured?”

Paper Preparation

Examples of Hypothesis:

1-“Making a group of heterogeneous agents to communicate and learn improves individual agents’ performance”

2-“Most of the programs can be transformed using the new AOP paradigm”

Examples of Prediction:

1-“Using a set of heterogeneous agents will improve the measure of the quality of traffic control. Different situations causing traffic congestion will be resolved”

2-”Using Aspects make programs more portable”

Paper Preparation

Before testing the hypothesis and predictions:

- Make a list of main sources to check before entering the library or the Internet

- Gathering and Organizing information
  - Read each source
  - Take notes and summarize
  - Use quotes for transcriptions
  - Add bibliographic information (author's name, title of the book/article, publication information)
  - Keep track of this work in a log book (log page in your web site, Log files…

Paper Preparation

Summarizing:

- Select a small concrete topic related with your research interest
- Summarize the state of knowledge on the general topic
- Define (one or several) hypotheses that can be tested
- Relate your work to general body of knowledge on the topic
- Make predictions based on the Hypotheses

- Recall the research you already made on the subject
- Gather and Organize all the existing information
- Revisit your Notes
- Interpret the results
- Extract the conclusions
- Accept/reject the Hypothesis