

Research Methodologies: Introduction to Research



Research is

- n Knowledge acquisition gained
 - | through reasoning
 - | through intuition
 - | but most importantly through the use of appropriate methods

The Scientific Method

- | If research was not “written up,” did it really occurred?

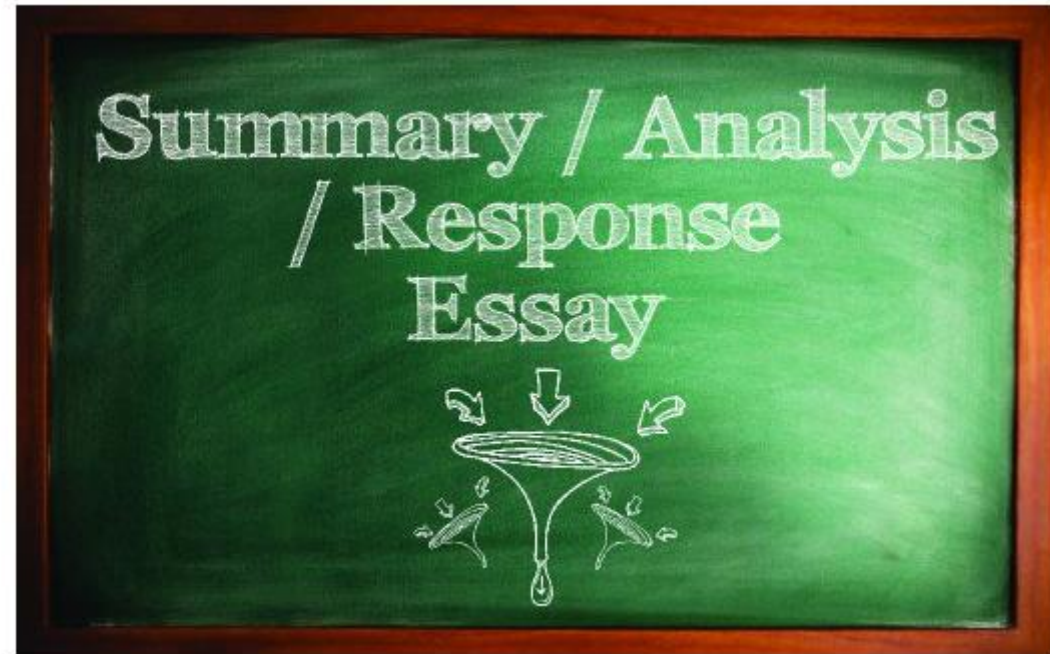
Writing a Research Report

- | Research is conducted to **discover facts, truths, and explanations** about the social world.
- | They write research reports to convey theirs and others' research findings.
- | The point is to provide **useful information to others**.
- | An article, paper, or report generally covers **only one important topic** of interest and conveys evidence and interpretations of evidence.
- | Research reports are NOT creative writing, opinion pieces, poems, novels, letters, musings, memoirs, or interesting to read.

Scientific Method

1. Choose a question to investigate
2. Identify a hypothesis related to the question
3. Make testable predictions in the hypothesis
4. Design an experiment to answer hypothesis question
5. Collect data in experiment
6. Determine results and assess their validity
7. Determine if results support or refute your hypothesis

Writing a Research Report



- | Summary tells the **main** ideas of the article in **your own words**.

Writing a Research Summary

- n Article, paper, or report generally takes a structure or form that seems difficult but is intended to help make reading it or using it for research quick and efficient.

- n A research report has seven components:
 1. Abstract or Summary
 2. Introduction
 3. Review of Literature
 4. Methods
 5. Results
 6. Conclusions and Discussion
 7. References

- n Note: Qualitative research reports will vary from what is presented here.

Writing a Research Summary

1. Abstract or Summary:

The abstract or summary tells the reader very briefly what the **main points** and **findings** of the paper are.

| This allows the reader to decide whether the paper is **useful to them**.

| Get into the habit of reading **only abstracts** while searching for papers that are relevant to your research.

| Read the body of a paper only when you think it will be **useful to you**.

Abstract — Practices of numerous diversified machineries in different areas of human life (such as environmental monitoring, energy management, media, infrastructure management, medical and healthcare systems and transportation) has become so popular nowadays that it would be very difficult to employ large-scale infrastructures without using these smart and elegant devices. These devices (such as sensors, surveillance devices, smart phones, actuators etc) incorporate properties like sensing data, connectivity, unique identity, mobility and data transfer capabilities. Based on considerable change in traditional ways of computing (i.e. PC, server and network) and growing technological evolution of computing devices, IoTs have become vital part of modern computing world especially for the large-scale infrastructures. The concept of IoTs is future of smart and intelligent applications like smart homes, smart cities smart industries and organizations. On the other hand, for such huge footprint of data and computing devices, it is of the leading importance to diminish the new challenges of data management and analysis. Millions of connected devices are engendering data at a higher speed demanding for comprehensive and futuristic approaches of handling data to offer flexible data acquisition, gathering, processing and management services. The core objective of this paper is to identify challenges for emerging technologies in IoTs, with a specific and focused approach on data management architectures and techniques in IoTs. Moreover, the paper shall provide comprehensive analytical overview of currently available data management techniques.

Writing a Research Summary

2. Introduction:

The introduction tells the reader what the topic of the paper is **in general** terms, why the topic is important, and what to **expect in the paper**.

| Introductions should funnel from **general ideas to the specific topic of the paper**.

| Introductions are sometimes folded into literature reviews.

I. INTRODUCTION:

Internet of Things is one of the concepts, which tends to build new futures of computing by taking every smart object into a globally connected network capable of sensing, communicating, information sharing and performing smart analytics for different daily life applications [1][7]. This is result of rising technological evolution of computing devices, discovery of nanotechnology and excessive usage of smart objects in human life that forces towards development and utilization of a global network with smart and connected objects. Last decade is witness of such changes in human life's perspective [1][5][7][8][13].

Furthermore, it has been observed that this wave of smart things is serving in different areas such as education, medical, military, research, sports and industries [5][15][17]. One of the application switches that IoT has made possible is smart home concept. Smart home offers services like access control, home monitoring, safety and central control of numerous home appliances to its owner [4][11][15]. Basic idea of smart homes is to connect home appliances in network architecture and employ use of some standard protocols for communications. Smart sensors and cameras

Writing a Research Summary

3. Review of Literature:

The literature review tells the reader what other researchers have discovered about the paper's topic or tells the reader about other research that is relevant to the topic.

- | A literature review should shape the way readers think about a topic—it educates readers about what the community of scholars says about a topic and its surrounding issues.
- | Often what students call a “research paper” is merely a review of literature.
- | Along the way it states facts and ideas about the social world and supports those facts and ideas with credit for where they came from.

III. RELATED WORK:

The core reasons of huge amount of data generation in Internet of Things are data analysis, information management, transformation, knowledge creation and effective decision making for different application parameters. Consequently, this large amount of data engendered by the IoT devices requires more and more computational power to process. Further, data generated by IoT devices in different application domains is time critical. Therefore, processing such data in timely manner is very demanding in Internet of Things. But at the same time, considering device capabilities and context is also equally important for Complex Event Processing (CEP). In this section, we briefly discuss the most important research outcomes for IoT data management as follow:

(i) Farzad et al. in [20], propose a framework to develop and deploy IoT applications in cloud. The designed framework benefits from the current modules of Aneka and additionally pays attention towards novel features needed for IoT applications. For communication between data sources and Aneka platform, a lightweight protocol MQTT is utilized. The proposed framework has three major elements i.e application manager, cloud manager and data source manager. Application manager is partitioned into components like, Application Composer, Application Monitor, Scheduler and Load Balancer. These components provide user with application side functionalities such as creation, scheduling and monitoring of applications.

Writing a Research Summary

4. Methodology:
- SECTION MUST CONTAIN:
- I Descriptions of Data
- ▶ Think in terms of: “Who, What, When, Where, Why and How?”
 - ▶ Target Population
 - ▶ The Ways Data were Collected:
 - Sampling
 - Delivery Methods
 - ▶ Response Rates
 - ▶ Limitations of Data (Who is omitted, biases)
 - ▶ Any analysis necessary to bolster claims the data are appropriate

IV. TRUST-BASED ENERGY EFFICIENT SECURE ROUTING PROTOCOL

In this section, our proposed routing protocol called Trust-based Energy Efficient Secure Routing Protocol (TEESR) has been discussed. The section ends with set of experiments, comparing our proposed routing protocol with the existing protocols present in the literature.

The design of this protocol is based on three principles: First, the protocol restricts malicious nodes in its vicinity by using appropriate authentication and flooding mechanism. Secondly, The protocol perform resource-intensive computations such as building routing tables, trust tables, security and intrusion tolerance issues at the BS and minimize the computation, storage and bandwidth requirements at the nodes. Thirdly, the protocols uses multipath overlay networks to exploits redundancy and tolerates intrusions in a region and operates correctly in the presence of (undetected) intruders. As shown in Figure1, hierarchical network architecture is formed by the Base Stations (BS), CH-sensors and SF-sensors. The network is divided into small clusters. Each cluster consists of SF-sensors (Sensing and Forwarding) and CH-sensors. CH-sensors or sink nodes have more energy, high data rate and long transmission range and more advantages for designing better secure routing protocols. CH sensors serve as the cluster heads CHs and form the backbone network. SF-sensors send data to their respective CH-sensors. CH-sensors also remove redundant data, aggregate data from multiple L-sensors and through the CH-sensor backbone network, compressed packets are sent to the BS. The protocol applies MAC (Message Authentication Code) for integrity of message and Symmetric key cryptography for discovering a safe route against black hole attack. In our protocol, first Clusters with backbone

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4. Methods

Sample

We use a nationally representative sample survey of U.S. households, the 1998 General Social Survey (GSS) (Davis and Smith 1999). The GSS is conducted by the National Opinion Research Center at the University of Chicago on a biennial basis in face-to-face interviews with English-speaking adults. The GSS employs a full-probability sample, which means that all noninstitutionalized

Measures

In order to measure support for the use of force by police personnel, we use five questions from the 1998 GSS that asked respondents about their approval of police striking citizens. (For a list of variables used, with individual coding

Social Attitudes. We measure *Political Views* with respondents' ratings of their political views on a seven-point scale, ranging from extremely liberal to extremely conservative. We also measure respondents' attitudes concerning the government's role in providing help for the poor and minorities with a scale

Analysis

Although others have used Ordinary Least Squares (OLS) regression on questions like ours in previous analyses (Arthur 1993; Arthur and Case 1994), we use logistic regression. This technique is more appropriate because the dependent variables are binary. If OLS regression were used, several important assumptions would be violated (Long 1997). For example, using OLS regression on a binary variable may cause inefficient coefficients, leading to incorrect test statistics. Also, OLS often predicts values of binary dependent variables beyond the limits of zero and one. Another important consideration is that OLS regression

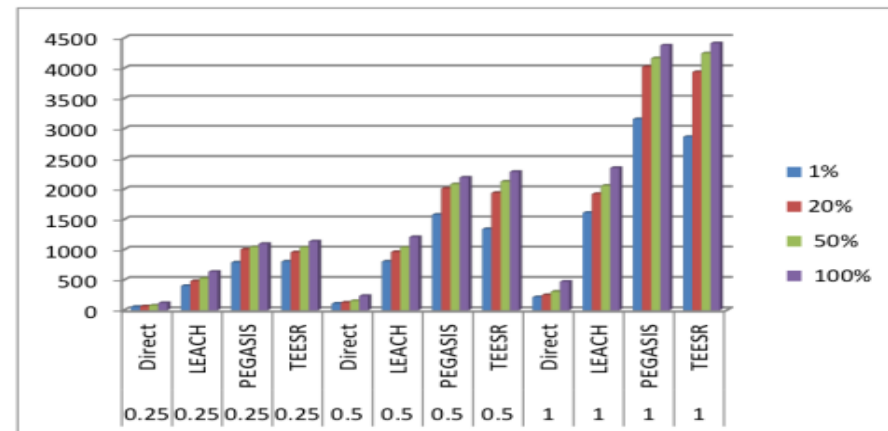
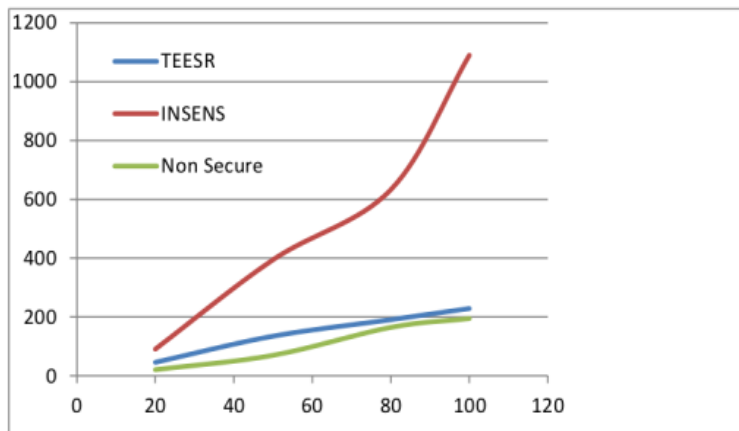
Writing a Research Summary

5. Results

The results section chronicles the findings of the statistical analysis and assesses whether your expectations (hypotheses) were correct.

This section includes:

- | Professional tables showing descriptive and inferential statistics
- | Narrative describing most relevant findings
- | The narrative and tables are complementary.
 - ▶ The narrative discusses **ONLY VERY IMPORTANT** findings and refers to where information can be found in the tables as different facts are discussed.
 - ▶ The tables contain almost all statistical information so that the author does not have to write a narrative for every detail in the analysis.



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6. Conclusions and Discussion

This section assesses how **one's research findings relate** to what the community of **scholars knew already**.

- | You should **summarize the most salient points of your research** (tell the reader what you found out about your topic).
- | Discuss the general significance of your topic and findings.
- | You should discuss the **shortcomings** of your study and what implications these have for your findings.
- | Discuss things **future** researchers should investigate about your topic.
- | Leave the reader with the understanding he or she ought to have about the topic you spent so much time exploring.

Writing a Research Summary

7. References:

- | The references are just as important as any other part of your paper.
- | They are the link to the community of scholars that will permit your reader to assess the worthiness of the claims you make in your paper.
- | References also make the research process much more efficient because they make it very easy to look up sources of facts and ideas.

REFERENCES

- [1] Karlof, Chris, and David Wagner. "Secure routing in wireless sensor networks: Attacks and countermeasures." *Ad hoc networks* 1.2 (2003): 293-315.
- [2] Sahoo, Mrs Soumyashree, Mr Pradipta Kumar Mishra, and Rabi Narayan Satpathy. "Secure Routing in Wireless Sensor Networks." *International Journal of Computer Science* 9 (2012).
- [3] SONG Fei, ZHAO Baohua. Trust-based LEACH protocol for wireless sensor networks Second international Conference on Future Generation Communication and Networking. Piscataway: IEEE, 2008:202-207.
- [4] Intanagonwiwat, Chalmek, Ramesh Govindan, and Deborah Estrin. "Directed diffusion: a scalable and robust communication paradigm for sensor networks." *Proceedings of the 6th annual international conference on Mobile computing and networking*. ACM, 2000.
- [5] Zahariadis, Theodore, et al. "An energy and trust-aware routing protocol for large wireless sensor networks." *Proceedings of the 9th WSEAS international conference on Applied informatics and communications*. World Scientific and Engineering Academy and Society (WSEAS), 2009.
- [6] C.E. Perkins, E. Belding-Royer, S.R. Das, Adhoc on-demand distance vector (AODV) routing, in: IETF RFC 3561, July 2003.
- [7] Pirzada, Asad Amir, and Chris McDonald. "Trusted greedy perimeter stateless routing." *Networks*, 2007. ICON 2007. 15th IEEE International Conference on. IEEE, 2007.
- [8] MAAROUF I K, NASEER A R. WSNoderater- An optimized reputation system framework for security aware energy efficient geographic routing in WSNs, IEEE/ACS International Conference on Comp
- [9] CHEN Jing, ZHANG Huanguo, HU Junhui. An efficiency security model of routing protocol in wireless sensor networks, Second Asia International Conference on Modeling & Simulation. Washington D.C. : IEEE Computer Society .2008: 59-64.

Writing a Research Summary

Finally...Avoiding Plagiarism

n What is it?

- | All knowledge in your head has either been copied from some place or originally discovered by you.
- | Most knowledge was copied.
- | This is true in most settings. General knowledge is copied.
- | Humans are naturally copiers, but this is not what we would typically call “plagiarism.”

Writing a Research Summary

Finally...Avoiding Plagiarism

n What is it?

- | Among other things, plagiarism refers to taking others' work and representing it as if it were your own.
- | In academics this is bad because with plagiarism:
 - ▶ One cannot assess students' development accurately
 - ▶ The person who makes his or her livelihood by scholarly pursuit is being robbed of credit
 - ▶ It masks the lineage of ideas and facts.

Writing a Research Summary

Finally...Avoiding Plagiarism

I To avoid plagiarism:

1. **Document every source** for information that is not “general knowledge”—this includes facts and ideas.
2. **Cite every time a fact or idea** is used unless it is clear that one citation is referring to a group of facts or ideas.
3. If you quote material, put quotation marks around the quoted stuff and include a page number within the citation.
4. It is alright to paraphrase material, but you still have to cite from where the paraphrased material came.
5. When in doubt, cite the source.

Writing a Research Summary

n Steps to writing a great summary:

1. **Read the article**, one paragraph at a time.
2. For each paragraph, **underline the main idea sentence** (topic sentence). If you can't underline the book, **write that sentence on your computer or a piece of paper**.
3. When you finish the article, **read all the underlined sentences**.
4. In your own words, **write down one sentence that conveys the main idea**. Start the sentence using the name of the author and title of the article
5. Continue writing your summary by **writing the other underlined sentences in your own words**. Remember that you need to **change both the words of the sentence and the word order**.
6. Don't forget to **use transition words (Although, However, In addition, furthermore)** to link your sentences together.
7. Make sure you include the **name of the author and article** to let the reader know you are talking about what the author said and not your own ideas.
8. **Re-read** your piece. Does it flow well? Are there too many details? Not enough? Your summary should be as short and concise as possible.

Writing a Research Summary: Example

Tavernier and Willoughby's (2014) study explored the relationships between university students' sleep and their intrapersonal, interpersonal, and educational development. While the authors cited many scholars who have explored these relationships, they pointed out that most of these studies focused on unidirectional correlations over a short period of time. In contrast, Tavernier and Willoughby tested whether there was a bidirectional or unidirectional association between participants' sleep quality and duration and several psychosocial factors including intrapersonal adjustment, friendship quality, and academic achievement. Further they conducted a longitudinal study over a period of three years in order to determine whether there were changes in the strength or direction of these associations over time. They predicted that sleep quality would correlate with measures of intrapersonal adjustment, friendship quality, and academic achievement; they further hypothesized that this correlation would be bidirectional: sleep quality would predict psychosocial measures and at the same time, psychosocial measures would predict sleep quality.

End of Chapter

