Research Methodology

Presented By:

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Outline

- Introducing Research
- Reviewing Existing Literatures
- Selecting Research Problem
- Defining Research Objectives
- Proposing a new concept
- Evaluating the new concept

Which of these can be classified as research?

1. Mr. Zaved has prepared an article on “computer usage in secondary schools” after reviewing literature on the subject available in his university library and called it a piece of research.

2. Ms. Sarah says that she has researched and completed a document which gives information about the age of her students, their HSC results, their parents income and distance of their schools from the District Office.

3. Ms. Wania participated in a workshop on curriculum development and prepared what she calls, a research report on the curriculum for building technicians. He did this through a literature survey on the subject and by discussing with the participants of the workshop.

Which of these can be classified as research?

None of the previous examples can be classified under the name research.

Why?

- ✓ ***Hunting for facts or truth about a subject.***

Research

- ✓ ***Organized scientific investigation to solve problems, develop or invent new products.***

What is Research ?

Any honest attempt to study a problem systematically or to add to man's knowledge of a problem may be regarded as research.

(Theodorson and Theodorson 1969 cited in Reber 1995, p.663)

Research Defined and Described

"Research is a logical and systematic search for new and useful information on a particular topic"

- Systematic and orderly (following a series of steps)
- Purpose is new knowledge, which must be reliable

This is a general definition which applies to all disciplines

Research is not

Accidental discovery :

1. Accidental discovery may occur in structured research process
2. Usually takes the form of a phenomenon not previously noticed
3. May lead to a structured research process to verify or understand the observation

Research is not … cont.

Data Collection:

- an intermediate step to gain reliable knowledge
- collecting reliable data is part of the research process

Research is…

1. Searching for explanation of events, phenomena, relationships and causes:
   - What, how and why things occur
   - Are there interactions?

2. A process
   - Planned and managed to make the information generated credible
   - The process is creative
   - It is **cir**cular – always leads to more questions

Research is…Cont

- All well designed and conducted research has potential application.
- Failure to see applications can be due to:
  - Users not trained or experienced in the specialized methods of economic research and reasoning
  - Researchers often do not provide adequate interpretations and guidance on applications of the research
- Researchers are responsible to help users understand research implications (How?)

What are the Objectives of Research?

The prime objectives of research are :

1. to discover new facts
2. to verify and test important facts
3. to analyze an event or process or phenomenon to identify the cause and effect relationship

What are the Objectives of Research?

4. to develop new scientific tools, concepts and theories to solve and understand scientific and nonscientific problems
5. to find solutions to scientific, nonscientific and social problems
6. to overcome or solve the problems occurring in our everyday life.

What Makes People do Research?

This is a fundamentally important question. No person would like to do research unless there are some motivating factors. Some of the motivations are the following:

1. to get a research degree (Doctor of Philosophy (Ph.D.)) along with its benefits like better employment, promotion, increment in salary, etc.

2. to get a research degree and then to get a teaching position in a college or university or become a scientist in a research institution

What Makes People do Research?

3. to get a research position in countries like U.S.A., Canada, Germany, England, Japan, Australia, etc. and settle there.

4. to solve the unsolved and challenging problems.

5. to get joy of doing some creative work.

6. to acquire respectability.

What Makes People do Research?

7. to get recognition.

8. curiosity to find out the unknown facts of an event.

9. curiosity to find new things.

10. to serve the society by solving social problems.

Classifying Research

Taking purpose as the basis of classification, research is considered to be two types-Basic and Applied (including Developmental research).

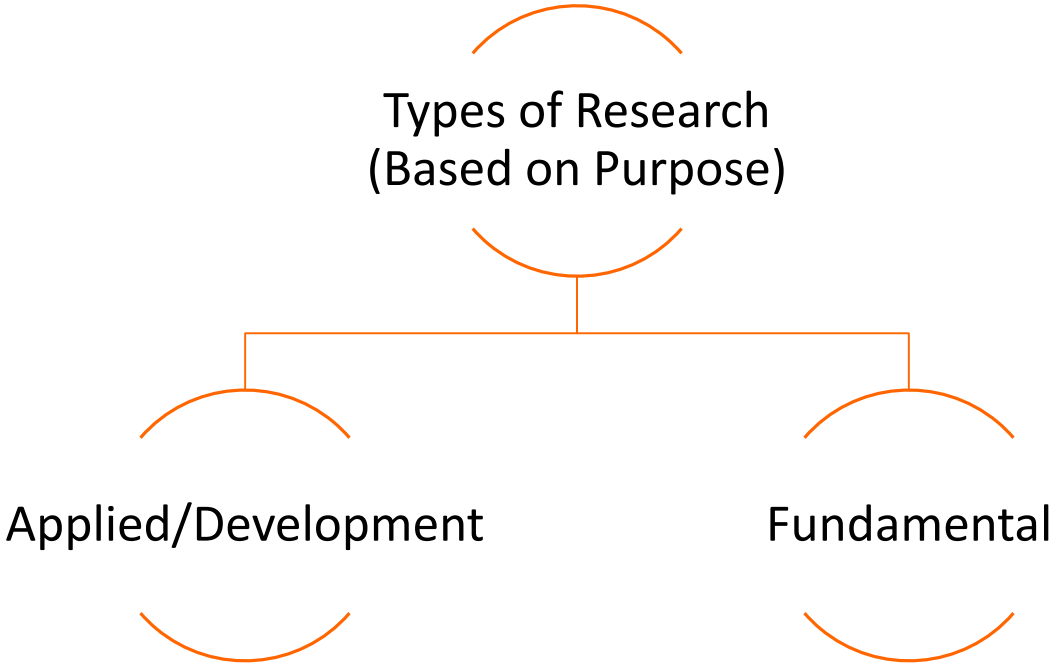
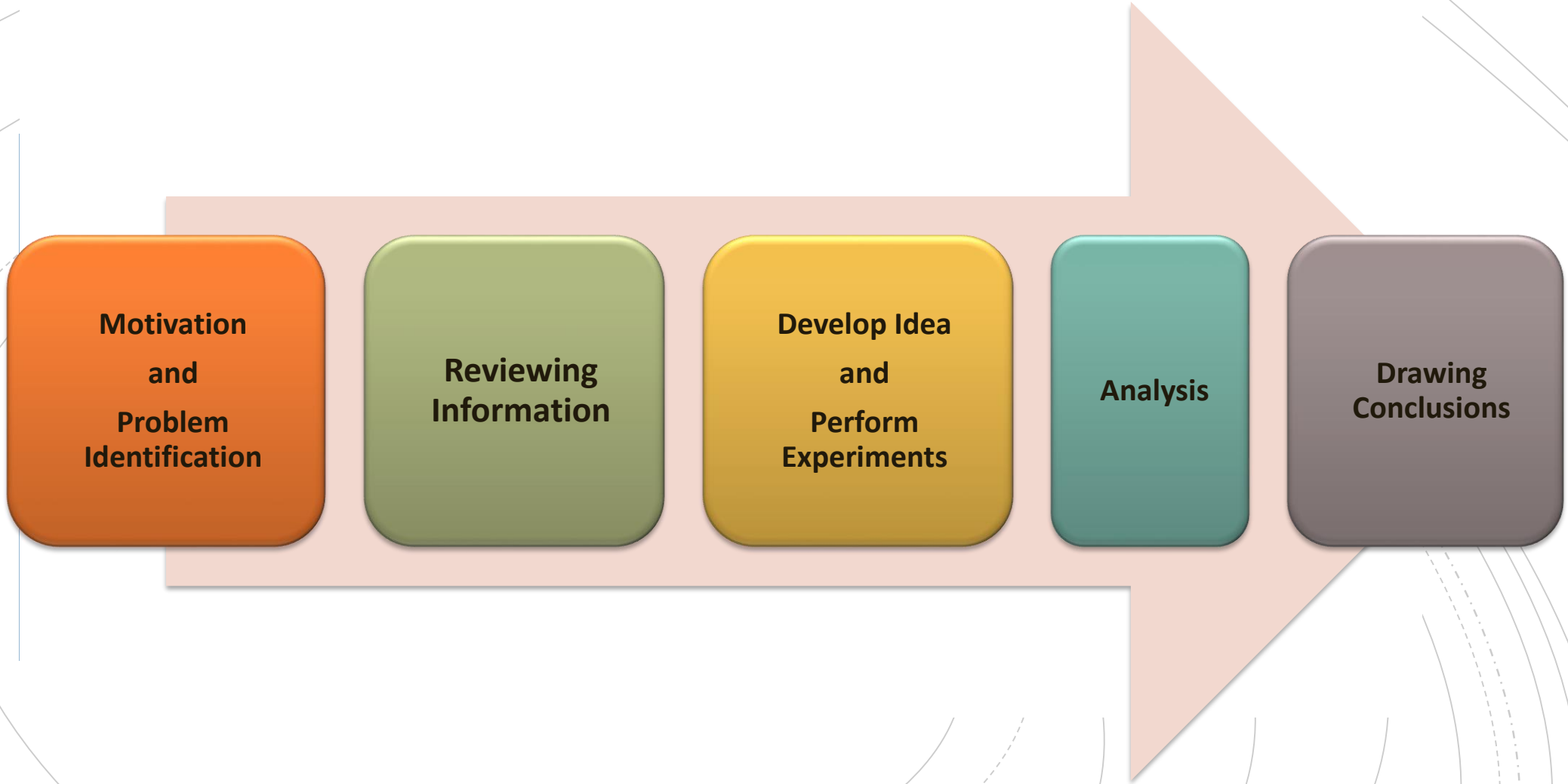


Fig: Classification of Research by Purpose

Basic research has no immediate application, whereas applied research is research that does.

However, almost all basic research eventually results in some worthwhile application in the long range.

This general systematic characteristic of research is illustrated below:



Steps of Conducting Research

Irrespective of the category of a research study, the steps followed in conducting it are the same.

These steps are :

- Selecting and Defining a Problem
- Conducting and Analyze Literature Review
- Describing Methodology of Research
- Collecting Data
- Analyzing Data and Interpreting Results

Motivation of Research

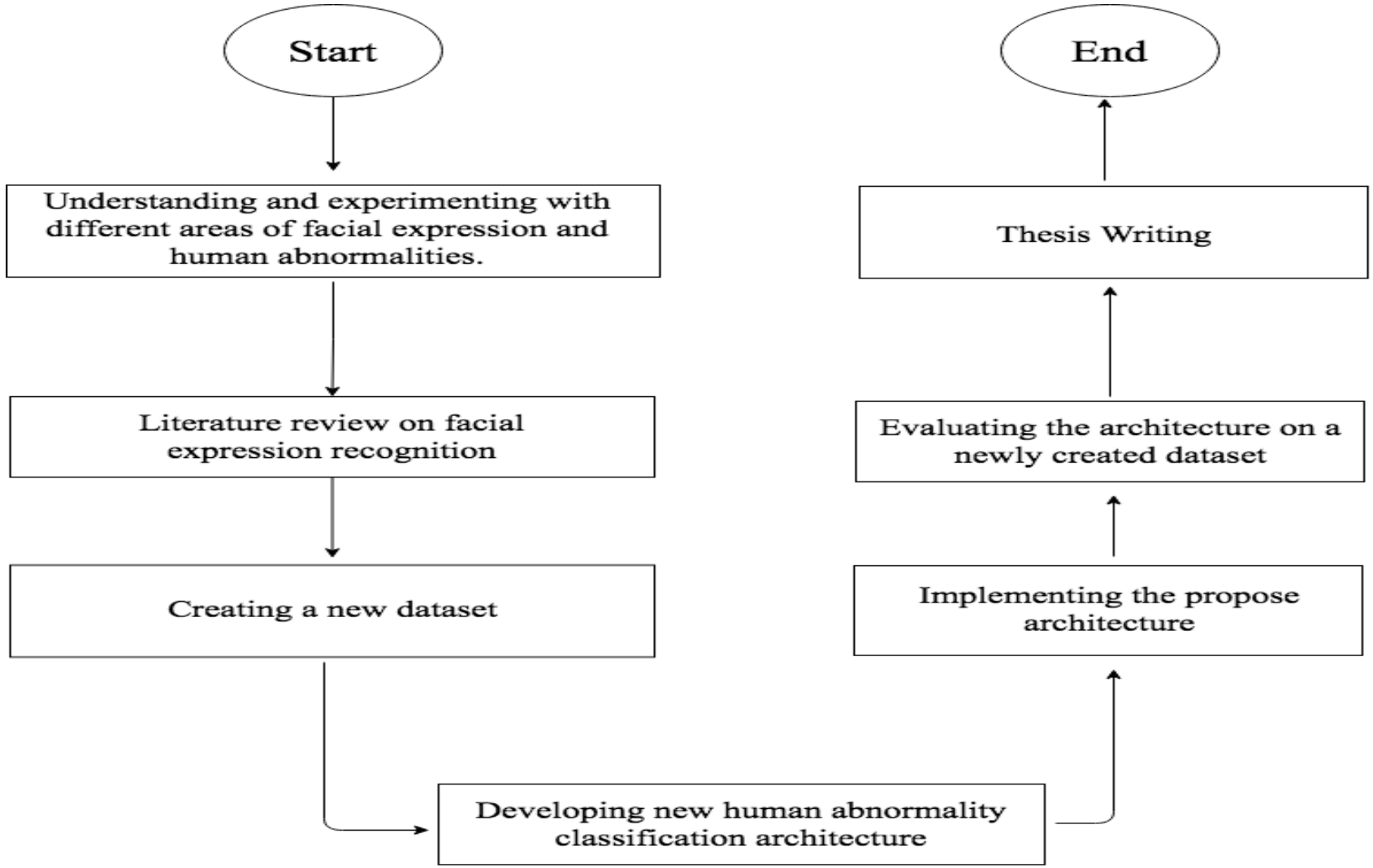
- To provide solutions to complex problems
- To make new discoveries
- To develop new products
- To save costs
- To improve our life

Motivation of Research (Example)

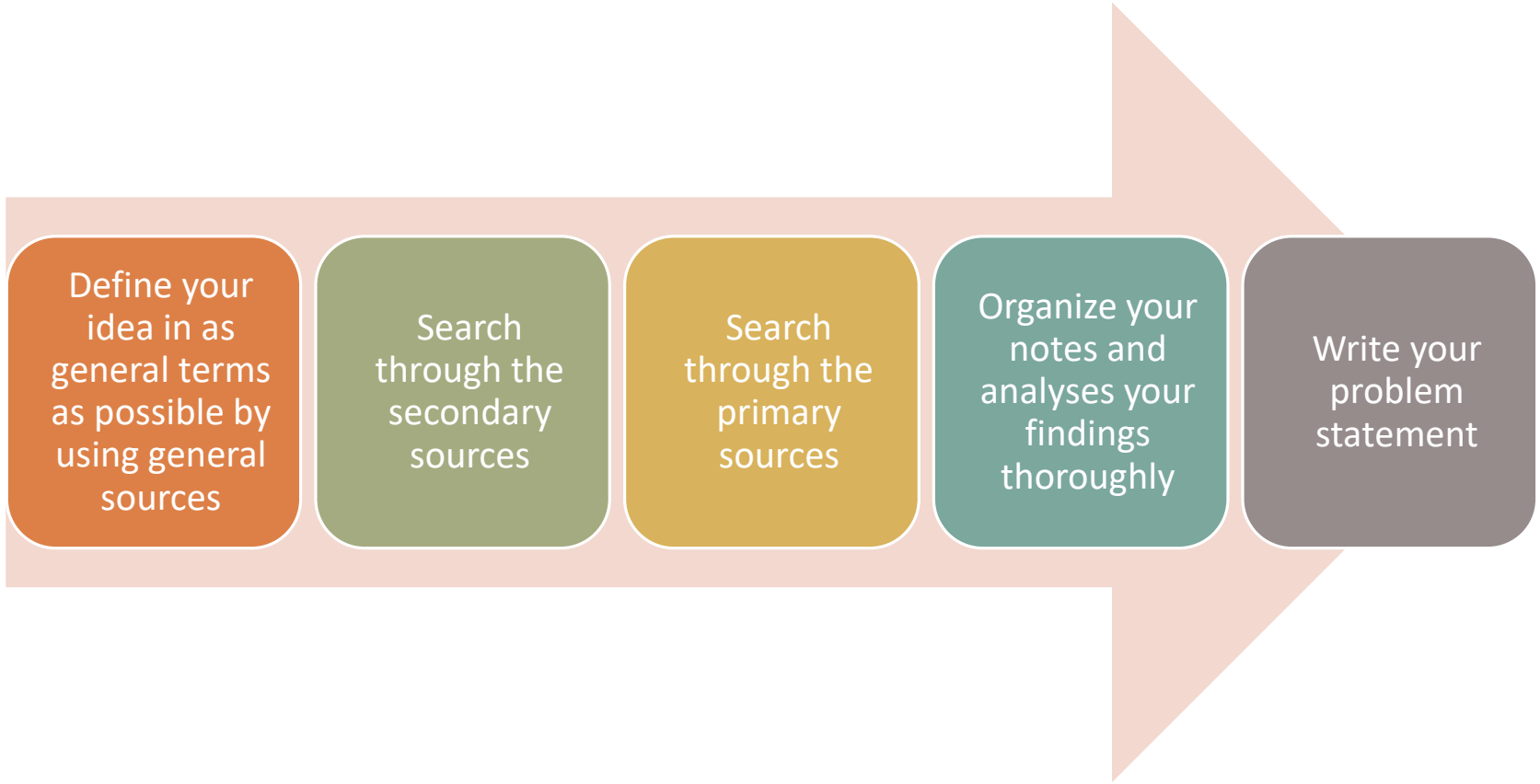
Finding human abnormalities such as:

- **Drug addiction**
- **Criminalist**
- **Autistic**
- **Or Normal**

Research Framework



Reviewing Literature



Reviewing Literature

General Sources

- Provides an overview of a topic and provides leads to where more information can be found.
- Examples are internet, daily newspapers, news weeklies, popular periodicals and magazines, (e.g. IEEE Spectrum), etc.

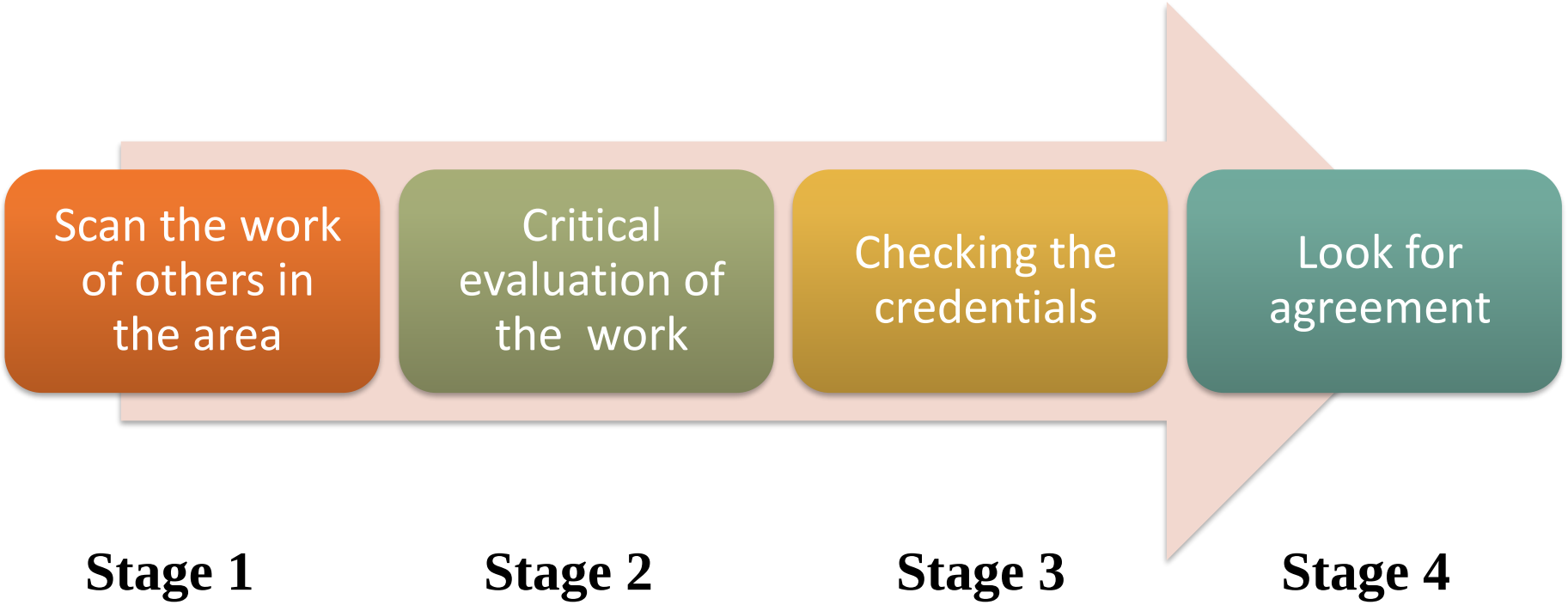
Secondary sources

- Provides a level of information “once removed” from the original work.
- Examples are books on specific subjects and reviews of research.

Primary sources

- The original reports of the original work or experience
- Examples are journals, abstracts, scholarly books, etc., obtained from academic library or the internet

Reviewing Literature



Conducting a good literature review is a matter of experience.

Even the top scientists have fallen into the trap of using poor evidence.

Format of the Literature Review

- The format of a review of literature may vary from discipline to discipline and from assignment to assignment.
- A review may be a self-contained unit -- an end in itself -- or a preface to and rationale for engaging in primary research.
- A review is a required part of grant and research proposals and often a chapter in theses and dissertations.

1. Introduction → 2. Body → 3. Conclusion

Format of the Literature Review

1. Neha Jain et al. proposed the face emotion recognition model, a combination of deep CNN and RNN models. In this model, the author used two datasets: MMI Facial Expression Database (TFD) and the Japanese Female Facial Expression (JAFFE). In this model, 80\% of datasets are used for training, and 20\% of datasets are used for validation. Achieve 94.91\% accuracy when used with JAFFE datasets and achieve 92.07\% accuracy when using MMI datasets.
2. Ali et al. proposed deep neural network architecture presented for automated facial expression, which has two convolutional layers. One is max pooling, another is four inception layers, and firstly applies the inception layers. The proposed approach takes a facial image as input and classifies that image into 6-expression or neutral. The author used different databases such as Multi-PIE, MMI, CK+, DISFA, FERA, SFEW, and FER2013 and achieved 94.7\%, which is the best accuracy using the CMU Multi-PIE database.

Selecting and Defining a Problem

This marks the beginning of a research study and is the most difficult and important step. This involves :

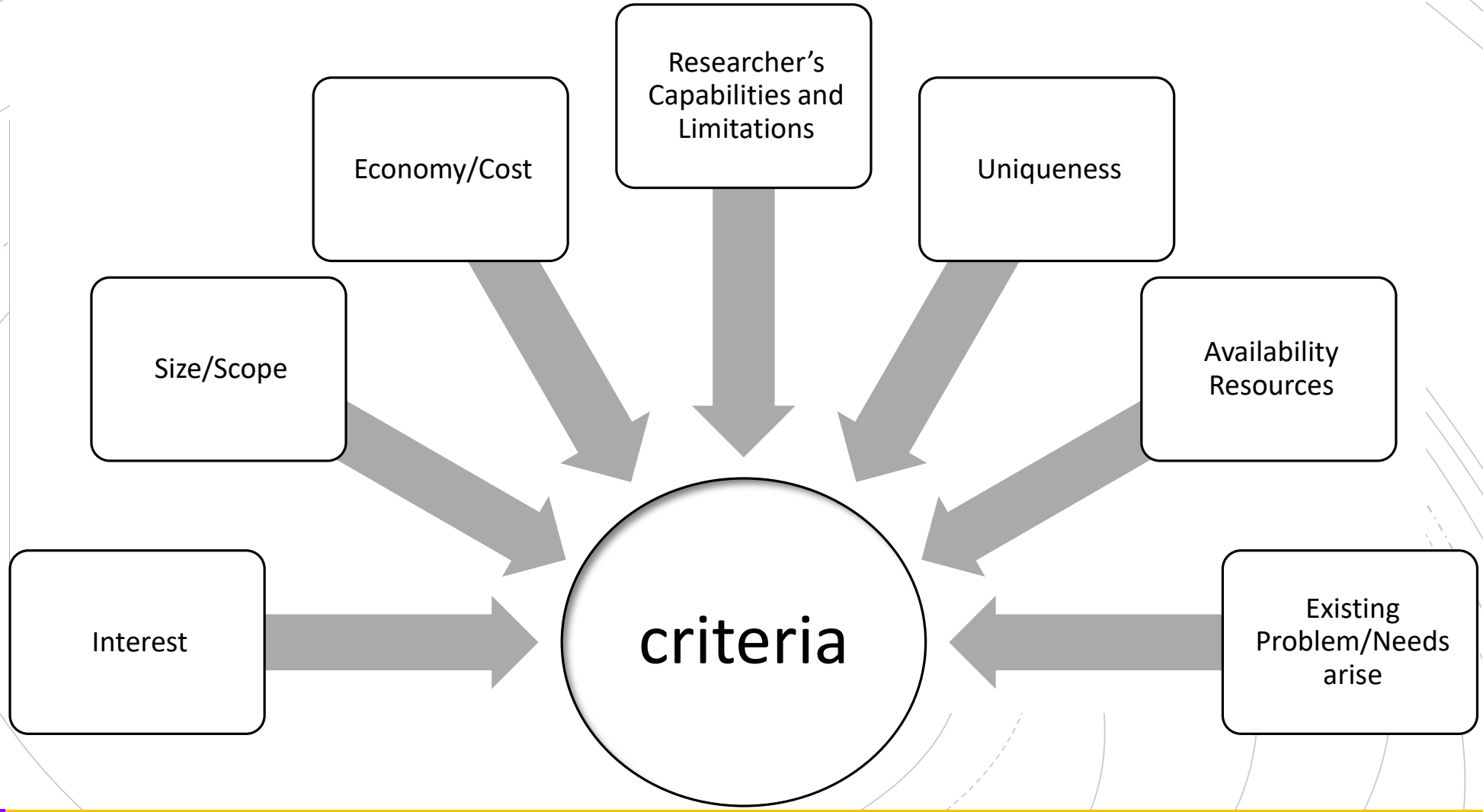
Problem Statement
Identifying and stating the problem in specific terms;

Research Questions
Identifying the variables in the problem situation and defining them adequately;

Research Objectives
Generating tentative guesses (hypotheses) about the relation of the variables or in other words **the solution of the problem**;

Scope of Research
Evaluating the problem for its research scope.

Criteria for Selecting a Research Problem



Problem Statement

- **A problem statement** is a concise description of an issue to be addressed or a condition to be improved upon.
- **It identifies** the gap between the current (problem) state and desired (goal) state of a process.
- To achieve this,
  - **reviewed literature** related to the problem to know
  - **Identified what other researchers have done** and
  - **discovered and to identify the possible methodology** for conducting the research.

Problem Statement (Example)

Analyzing facial expression and the manifestation of actual human emotions is one of computer vision's promising areas. Facial expression analysis becomes more pledging because of its human behaviour analytical power. Real-time facial expression analysis and finding facial pattern has remained a challenging and exciting problem in computer vision. Generating a useful pattern of facial expressions is a complex problem for deep learning techniques since people can vary significantly in the way they show their faces. In this work, we design a combined model to generate significant human face patterns to detect abnormalities, such as drug addicts, criminals, autistic, and regular people. The datasets available on the internet are not bringing to perfection because of these classified basic expressions of the human face. Therefore, the world has never seen such human abnormalities detection architectures.

Research Objectives

You need to state the **purpose of the study** and to define the problem clearly.

At this phase, you can generate some **Tentative guesses (hypotheses)** about the relation of the variables or in other words the **Solution of the problem**;

Research Objectives (Example)

- Identifying present difficulty in human abnormalities classification.
- Creating a new dataset named Normal and Abnormal Humans Facial Expression (NAHFE).
- Reducing computational complexity for human abnormalities classification.
- Developing a new combined CNN-RNN approach to classify human abnormalities accurately.
- Comparing the existing architectures with the proposed one for the abnormalities classification task.

Research Scope

Every research has its own boundary and constrains, since **one cannot solve or address all the problems** of the universe in one single research.

Hence, it always important to **identify what you can address in your research** via your research scope.

Research Scope (Example)

- Identifying present difficulty to analyses human abnormalities in Facial Expression Recognition (FER) problems.
- A new dataset named Normal and Abnormal Humans Facial Expression (NAHFE) dataset consists of 1936 images of 4 different classes.
- A novel CNN-RNN combined approach to classifying human abnormalities is proposed and got a convincing result. The CNN-RNN combined approach is unique and believed to have enormous potentials. Also, the impact of the proposed CNN-RNN combined architecture is compared to basic CNN architecture.

Proposed Method

- From the literature review, you have already identified some basic considerations
- From your problem statement and research objective you have also figured out your goal
- Now its time to develop your solution
- After developing the solution, its required to evaluate the proposed method via
  - **Step 1: Mathematical Analyses**
  - **Step 2: Simulation Results in Simulation Environment**
  - **Step 3: Conduct Experiment in Test Bed**

Pre-processing

- Data normalization
- Data augmentation
  - Appearance filters
  - Transform matrices

$$\Psi(\pi,\theta) = \frac{\xi(\pi,\theta) - \mu(\pi,\theta)}{6\sigma(\pi,\theta)} \quad (1)$$

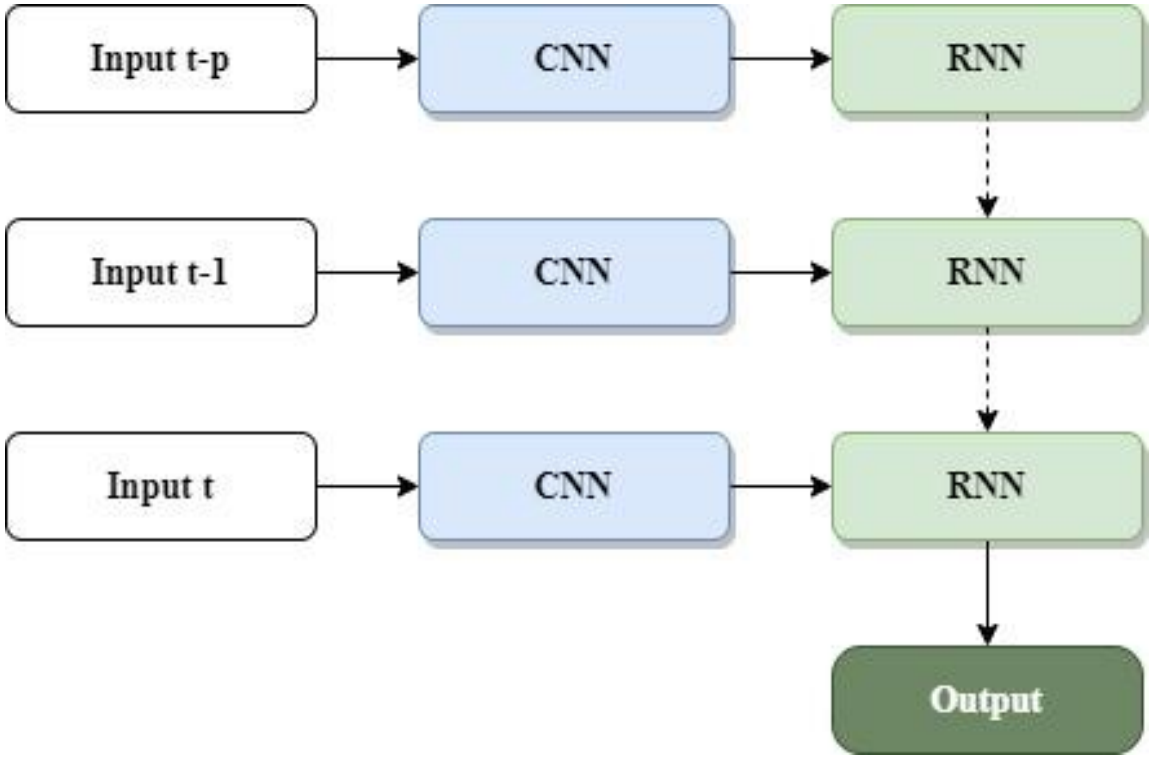
Where μ is a local mean and σ is a local standard deviation [12].

$$\mu(\pi,\theta) = \frac{1}{M^2}\sum_{k=-\alpha}^{\alpha}\sum_{n=-\alpha}^{\alpha}\xi(K+\mu,n+\theta)$$

$$\mu(\pi,\theta) = \sqrt{\frac{1}{M^2}\sum_{k=-\alpha}^{\alpha}\sum_{n=-\alpha}^{\alpha}[\xi(K+\mu,n+\theta)-\mu(\pi,\theta)]^2}$$

Methodology

- CNN
- RNN
- Combined CNN-RNN

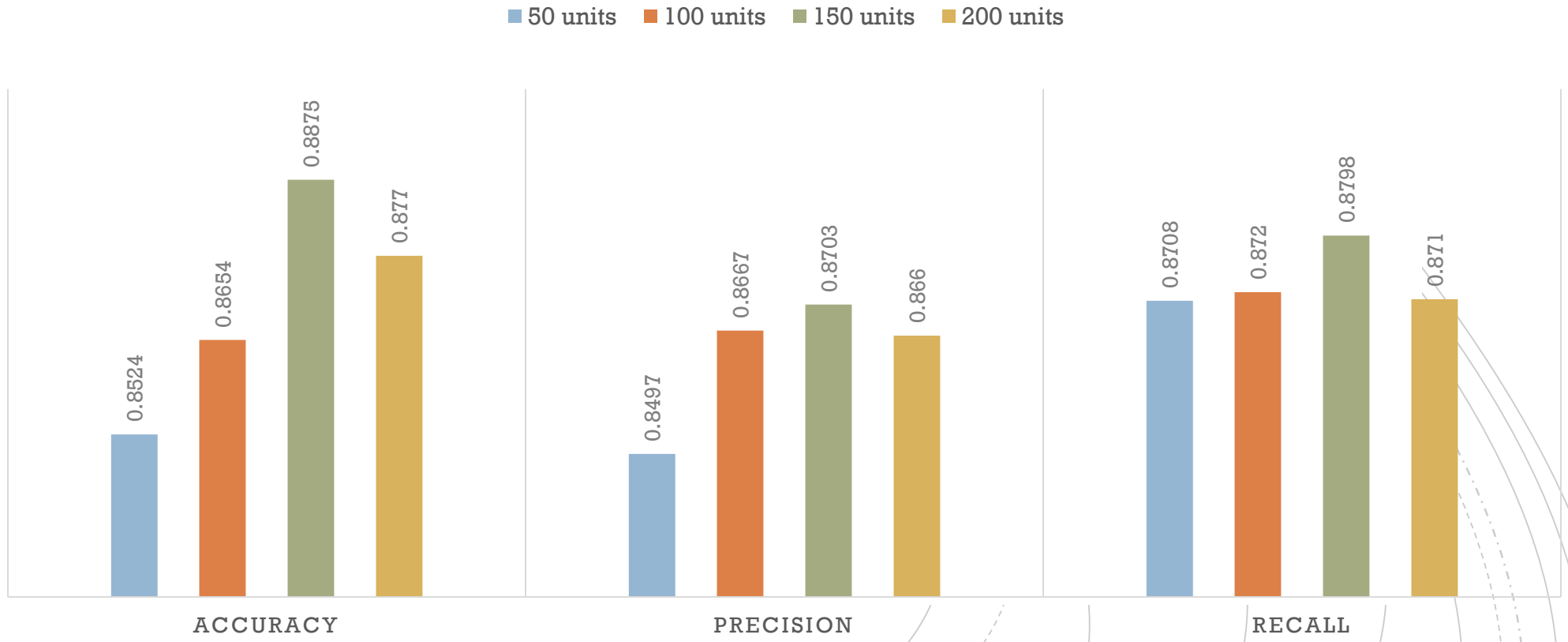


Evaluating the Solution

- The results of the study are generated at this stage.
- The data are summarized, in other words analyzed to provide information for testing the hypotheses.
- Appropriate statistical methods of analysis are used to test the hypotheses.
- You can perform the analysis manually, by using a hand calculator or a computer as per the demands of the problem, and the available facilities.
- After completing the analysis results are tied together or summarized.

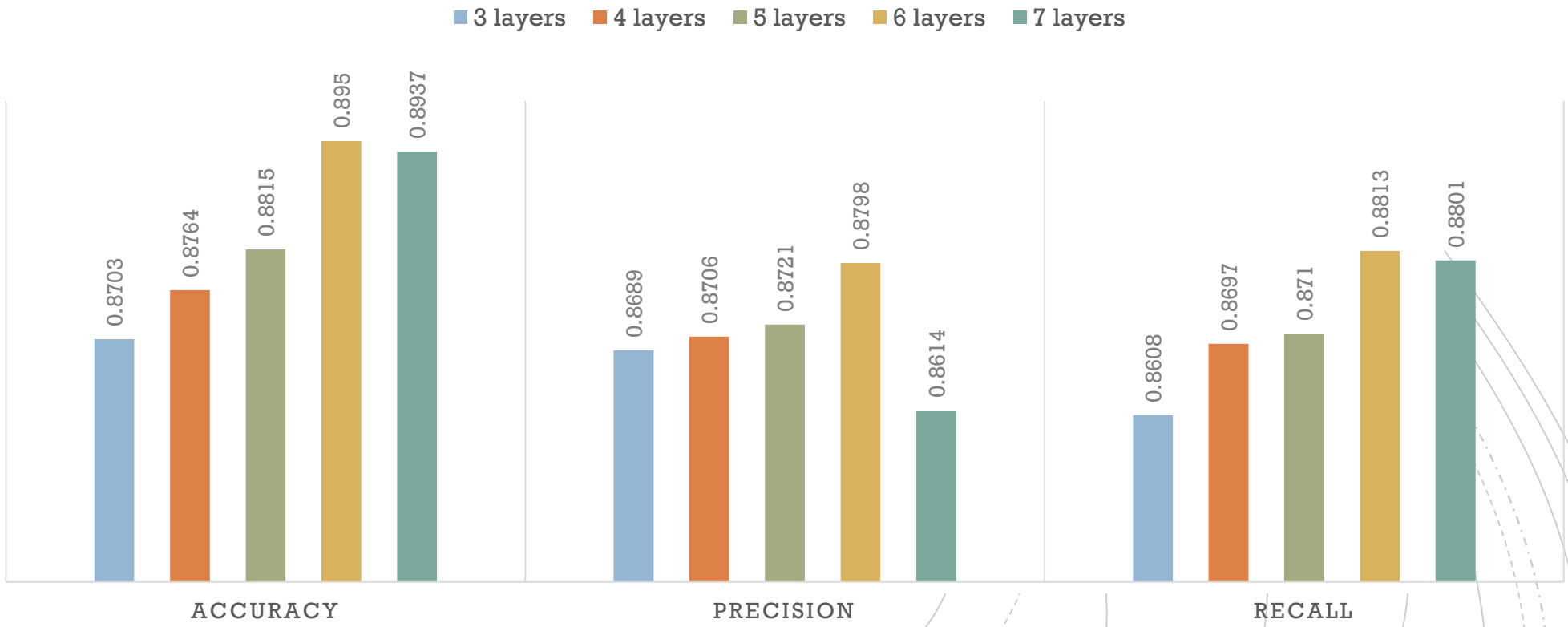
Evaluation

- Experimental Results: (Different hidden units)



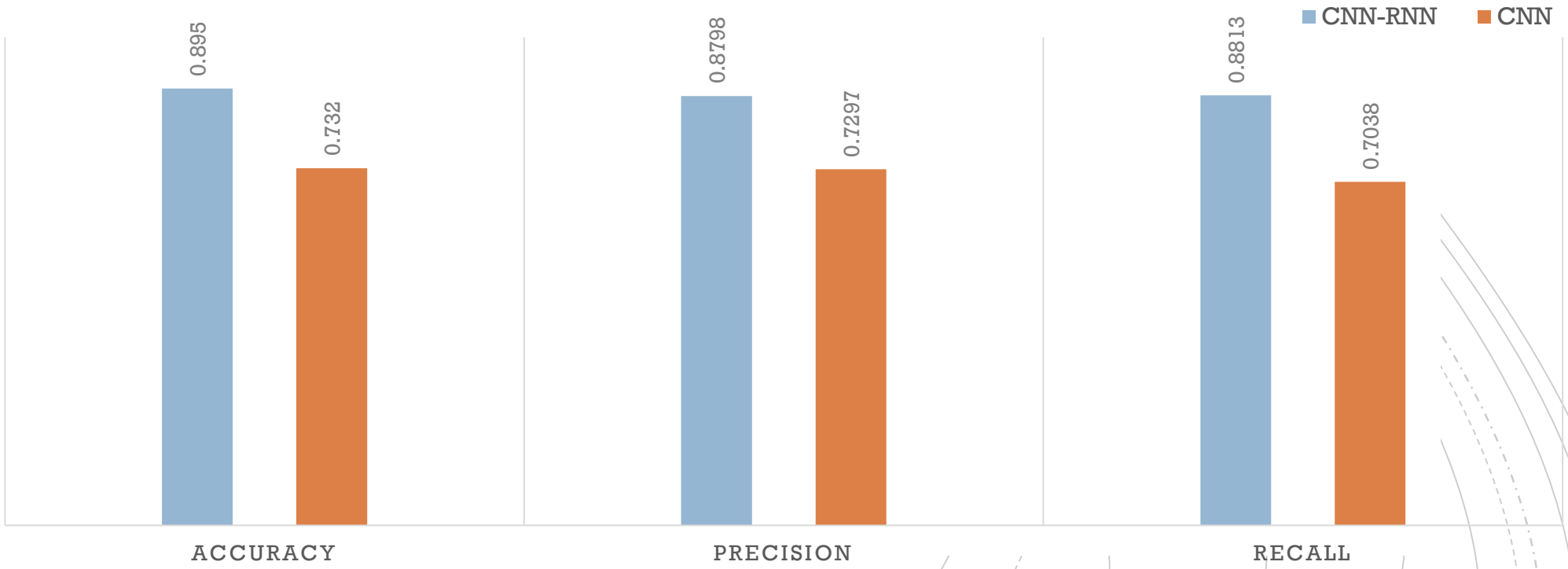
Evaluation (Cont...)

- Experimental Results: (Different hidden layers with 150 hidden units)



Evaluation (Cont...)

- Experimental Results: (150 hidden units & 6 hidden layers)



Typical organization of a paper

Introduction

- Background, objective, problem of the research and conventional technology for the problem
- New findings (proposal) and the way to validate the results
- Organization of the paper

Body

- Background technologies required to understand the new findings
- New findings
- Validate the new findings
- Conclusion
- Reference

The End

THANK YOU
SO MUCH

Any Question?