

UNDERGRADUATE PROJECT PROPOSAL

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| **Project Title:** | **Federated** **Convolutional Generative Network for Next Item Recommendation** |
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| **Module Name:** | **Project** |
| **Date Submitted:** |  |

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# Introduction

## Background

This section should describe the overview of the topic and motivations.

## In recent years, recommendation systems that utilize user project interaction sequences to improve real-world performance have become increasingly popular due to the fact that users typically watch or listen to a series of items consecutively, with strong correlations between these items. For example, users of Last. fm or Weishi typically enjoy a series of songs/videos over a period of time []. As a deep learning neural network architecture, CNN (Convolutional Neural Network) has excellent feature extraction capabilities and sequential data processing performance, making it very common to apply CNN to recommendation systems.

## Aim

The overall goal of your project should be stated here. It is recommended that each project should have a single aim.

In recent years, with the advancement of hardware and the development and application of deep learning technology, applying machine learning models to next recommendation has become increasingly popular. However, traditional CNN based recommendation systems still have some shortcomings. This paper proposes a federated convolutional generation network model for next recommendation to solve these problems and improve recommendation effectiveness.

## Objectives

Students are to state the several tasks/steps that would help them to accomplish the overall aim/goal of their project.

## Project Overview

(NB: Most students are working either on a software development-based project or a machine learning/deep learning-based project. Hence, in section 1.4, students must adopt the appropriate theme/content depending on their project topic.)

### Scope

The scope of a software development project should answer the questions: what will the software do? How will the software work? Scope for a machine learning/deep learning-based project should focus on answering the questions: what is the purpose of the study? How significant is the study?

The purpose of the study is to improve the next recommendation system by introducing a federated convolutional generation network model to overcome the shortcomings of traditional CNN recommendation systems. This model aims to better capture the features and sequential patterns in user project interaction sequences, thereby providing more personalized and accurate recommendations. Regarding importance, it has technological innovation and addresses the shortcomings of traditional methods. It also has significant importance for practical applications, improving user experience and having a positive impact in commercial applications.

### Audience

The audience for a software development project should focus on who is the software for? The audience for a machine learning/deep learning-based project should focus on who will benefit from the findings.

**(NB: This section can be written in two (2) paragraphs, with each paragraph capturing the scope and audience, respectively.)**

Users will be one of the main beneficiaries. The next improved recommendation system will provide more personalized and user interested recommendation content, thereby improving their user experience. Users will find products, services, or information of interest more easily, thereby saving time and effort. In addition, there are also businesses or advertisers who are the main beneficiaries. By increasing transaction volume, businesses can benefit, and advertisers can place more targeted advertisements to increase advertising efficiency. Technical researchers will also benefit from new technologies and methods.

# Background Review

Students doing software development-based projects can write their background review by providing a **summary of existing approaches (e.g., competitive analysis, if appropriate),** and others doing research-oriented projects (machine learning & deep learning projects) can write their background review by stating **a summary of related literature (e.g., annotated bibliography, or initial literature review, with a brief summary of sources).**

**Annotated Bibliography aids as in doing a good literature review. It is not the literature review. However, your final background review must be paragraphs with appropriate citations. Whenever appropriate, a table can be adopted.**

## The earliest work and ideas for sequence recommendation mainly relied on Markov chains [5] and feature based matrix decomposition [12] methods. Markov chains are a mathematical model in which the occurrence of an event only depends on the state of the previous event, and is independent of the earlier state. But it also has some shortcomings, especially when dealing with complex sequence data, its ability to model complex nonlinear relationships and patterns in sequence data is limited and lacks long-term memory. Afterwards, deep learning models gradually began to demonstrate advanced recommendation accuracy. In 2016, Hidasi et al. [15] proposed a DL based SBR system, commonly known as GRU4Rec. This is the first model to use RNN, which introduces session parallel small batch, output sampling based on small batch, and sorting loss function, resulting in significant results due to popular baselines. In 2018, Tang and Wang proposed a new sequence recommendation called Caser. They abandoned the RNN structure and proposed a convolutional sequence embedding model, demonstrating that this CNN based recommendation can achieve similar or superior performance in the popular RNN model's top-N sequence recommendation. Not long after the same year, Yuan et al. [] proposed a simple, efficient, and efficient convolutional generation model for session based top-N project recommendations. This model is suitable for short-term and long-term project dependencies and simplifies deeper network optimization. Ultimately, the model's recommendation accuracy and effectiveness are significantly better than existing technologies at the time. In 2021, Song et al. designed an effective SBRS called Intersessional Collaborative Recommendation Network (Insert) to recommend the next project in short sessions, and designed a Session Retrieval Network (SSRN) to identify sessions similar to the current short session from the historical sessions of the current user and other users, resulting in better recommendation performance than the most advanced series of recommendations at the time. Finally, in 2023, Kumar et al. proposed a Horizontal Vertical Convolutional Neural Network (HV-CNN) embedded with Word2Vec technology, which outperformed state-of-the-art methods on 30 publicly available music datasets.

# Methodology

## Approach

The approach for a software development project should focus on the description of the software development methodology, e.g., Software development model, requirement gathering method, testing, and evaluation process, etc.

The approach for a machine learning/deep learning-based project should focus on describing the core machine learning model to be employed. Briefly describe the mathematical basis, the algorithm details, and the optimization strategy, if applicable. Also, describe the datasets and data processing techniques to be used where relevant.

## Technology

State the implementation tools & resources, such as hardware and software.

## Version management plan

State your plan of how you intend to use resources such as, e.g., Git repository or shared drive to manage the several versions of **your project code or developed software**.

# Project Management

## Activities

State the tasks required to complete each objective. The details here can be presented by a table.

## Schedule

In this section, you can use a Gantt chart or other charts to show the activities and their deadlines.

## Data management plan

In this section, students must describe how they would use resources such as Baidu drive, Gitee, etc., to manage project logs, reports, literature, etc.

## Project Deliverables

In this section, briefly list all the documents and project resources that must be submitted for assessment. Example: Project proposal, progress report, final report, project code/ software, etc.

# References

Regarding citations and references, students must adhere to the University guidelines or IEEE referencing style.

**Students doing software development-based projects can cite related websites, web applications, developer documentation, etc. They can cite related articles to their projects, but it is not required. Students doing research-oriented projects should focus on citing research articles. They can also cite appropriate websites whenever necessary.**

## Formatting Requirements

Your written assignments must be presented in the following format:

* It must be word-processed in 11-point Arial font
* It must be black text on a white or ivory background
* All pages must be numbered
* Margins must be as follows: Top: 1 inch, Bottom: 1 inch (2.5 cm), Left: 1.25 inches, Right:
* 1.25 inches (3.2 cm)
* Use a line spacing of 1.5
* Numbers and captions to figures and tables should be at the bottom of the figure or table. If the figure or table is mounted sideways into the report, then its bottom is on the right-hand side of the report. **All tables and figures must be labeled**.
* Normally, the report should not contain more than 80 tables/figures.

## Written Presentation

* The project proposal must have a concise written presentation and referencing style.
* It should also have a clear & logical presentation.

**NB:**

1. **All the text in red colour are basic guidelines and must be DELETED after using this guide.**
2. **Finally, update the “Table of Contents” appropriately to display the correct section titles and corresponding page numbers.**