Face-Name Matching Game for Dementia Patients

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Bookies
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Submitted to —
Dr. Althea Liang
School of Computer Science and Engineering, Nanyang Technological University

Contents

Executive Summary

Over 45,000 people in Singapore suffer from Dementia. With a rapidly aging population, the number is projected to grow at an increasing rate. We have decided to develop a simple game for dementia patients which can act as an alternative/supplementary treatment method and an effective way for caretakers to monitor their patients.

The proposed game aims to treat dementia patients by exercising their facial recognition skills. By continuously training a patient's memory using the game, we aim to slow down and control symptoms of dementia that lower the mind's ability to recognize faces and people. Additionally, a patient's performance in the game can be used to monitor their treatment over time and whether the patient's condition is improving or deteriorating.

The application would have three primary features - authentication, historical analysis and the game itself. Authentication would allow different user types (administrator, caretaker or patient) to log in to the application and would determine their permissions. Historical analysis would provide a data visualization tool for caretakers to track and analyze their patient's performance in the game. The game itself would flash images of faces along with a set of potential names. The patient would be tasked with selecting the name corresponding to the face image within a limited amount of time before the next face is flashed. Since the application's primary users are the elderly, the user interface must be extremely minimal and intuitive to use.

The development of the entire web application is estimated to take a maximum of 12 months with an estimated budget of $380,000 involving a team of six developers and managers with a diverse skill set.

Statement of Problem

Dementia comprises a group of symptoms that progressively decline the cortical functions of the human brain including memory, language, cognitive abilities, and other relative thinking skills. The damage of the brain cells result in dementia and hinders the communication among the cells. Medically, it is hard to diagnose dementia. In Singapore there is an 45,000 dementia patients in 2015 and the numbers are expected to grow to 241,000 by the year 2050 [1].

Numerous studies suggest that verbal learning and memory can improve the condition of dementia patients. A study by Wilson, Kaszniak, Bacon, Fox and Kelly explains the effects of senile dementia of the Alzheimer's type (SDAT) on the verbal and facial deficits on patients [2]. The paper also shows that dementia patients have reduced retention of facial information. This is caused by the impairment of memory as well as the ability to focus. In addition, there is a reduction of reasoning and judgement abilities. This result in most dementia patients being unable to perform basic mathematical calculations or solve simple decision-making problems [3] [4]. With the numbers of dementia patient growing rapidly, the symptoms of dementia greatly vary. Thus, it is necessary for doctors and caretakers to be able to track and analyze their patients' progress in order to come up with personalized treatments.

The symptoms of dementia can have extreme variation across patients. Patients may have impairment in any two of the following - memory, communication skills, ability to focus, judgement, reasoning and visual perception. Thus, there is an urgent need to provide a simple activity or game to track the extent of a patient's impairments and provide a report on the effectiveness of their treatment. Such a games can easily provide a score for the user's memory and reasoning abilities. Additionally, the system can keep track of historical scores and let caretakers analyze whether the patient's condition is improving or worsening.

Objectives

The project we propose to develop is a game that aims to exercise the psychological capacities influenced by dementia. A few methodologies can be considered in the creation of such an application. Considering the majority of our intended interest group belong to the age category above 65 years old [1], the application needs to have carefully chosen goals. We mean to assemble the framework in light of the accompanying objectives:

1. The application must have a **clean and intuitive-to-use** interface.
2. The application must provide **accessibility modes** to accommodate a range of users.
3. The game must be **easy to play** and have **straightforward** guidelines.
4. The application must display **visualizations of past patient data** for caretakers.

Objective 1: Since most elderly people have negligible to no experience utilizing computer applications, the application must have a basic and suggestive user interface. The application's UI must give valuable clues to explore the framework and the colour scheme utilized in configuration must be warm. Following the Shneiderman's “8 Golden Rules of Interface Design”, short-term memory load will be reduced, ensuring high retention rate and satisfaction.

Objective 2: Because of the age group of most clients, the application must give a few accessibility features including (however not constrained to) expanded font sizes, neat textual styles, optional animations and a magnifier instrument for pictures. This is to guarantee that the application accommodates elderly people and isn't distressing to use for dementia patients.

Objective 3: Since reasoning and memory are two faculties of the mind affected by dementia, the game must be extremely simple to understand and play. The best approach is to design the game after games designed for little children and expel any pointless complexities or diversions to keep up the patient's concentration and consideration.

Objective 4: It is important for the application to store verifiable patient performance information gathered during the game. Data, for example, navigation, response speed, precision rate, direction cognition, and so on can be considered for therapeutic and scientific assessment.

Technical Approach

Customer Needs

For many years, Singapore's population has been aging at a rate faster than many countries in the world as a result of a low Total Fertility Rate. [9] It is estimated that the number of elderly citizens aged 65 and above will increase to 900,000 by 2030. [10]

Research from the Institute of Mental Health Singapore has found that 1 out of 10 citizens aged 60 and above suffered from dementia, making it one of the more common illnesses among the elderly. [11] Coupled with the growing number of dementia cases reported yearly, the number of dementia cases is projected to reach 103,000 in 2030 and 241,000 in 2050, making dementia an increasingly pressing issue for society. [9]

Many within the medical community share the view that preventing or delaying the deterioration of dementia can be achieved by simulating the brain's cognitive function. This can be achieved by practicing memory recall, which is done in many brain-training games. Therefore, a safe and user-friendly tool that allows dementia patients to stimulate their cognitive abilities from time to time would be beneficial to these patients.

A web application would be the tool of choice, given that the rapid advancements in technology has resulted in more senior citizens using electronic devices in their day-to-day life. [12]

In addition to providing the patient with an aid that they can use from the comfort of their homes, the tool would also make it easy for their data to be tracked and analysed by a doctor or caregiver.

To conclude, there is a need for an intuitive, elderly-friendly web application that allows patients to stimulate their memory and cognitive ability which keeps track of their performance data for use by doctors and caregivers.

Target Specifications

Specification 1: The loading time of the application must not exceed 2 seconds.

Rationale: The application will not have a smooth user experience if the user has to wait too long.

Specification 2: The application must respond to user input no longer than 1 seconds after the user has completed action.

Rationale: Any delay of longer than 1 second will interrupt the user's train of thought. [13]

Specification 3: The main menu of the application must be loaded within 3 seconds of starting the application.

Rationale: The application will be considered as inefficient if the user waits longer than 3 seconds to be able to use it.

Specification 4: The score must be updated by the application at the end of every round

Rationale: The application will be considered malfunctional if the score does not match the actual score obtained by the user. This might cause confusion to the user.

Design Concepts

After identifying and examining the design objectives and customer needs, the design concepts below were formed to help tackle the problem statement:

Design Concept Name	Summary	How was it generated	Minor changes to meet customer needs
Find it	Players must reveal 2 face down cards each time. If the cards that were revealed match, they are removed. The goal is to remove all cards by matching all pairs.	Game played as children	Cards can contain names of everyday items and players could be asked to identify them so that they can practise memory recall.
Fold it	Players are to fold a given piece of paper on the screen into the specified design either by dragging the cursor (with a mouse)	Having to precisely fold the paper according to the shape given improves hand-eye	Shapes folded could be modelled after everyday items and players could be asked to recognise these objects so that

	or their finger across the screen (in the case of a touch screen) Points will be awarded according to how closely the result of their folds resemble the original shape.	coordination often lacking in dementia patients	they can practise memory recall.
Sudoku	Players are to fill up a 9x9 grid with the digits 1 to 9 such that each column, row and 3x3 subgrid does not repeat a digit once it is in position.	Observed some elderly citizens solving such puzzles in the library	The digits could be replaced with everyday objects so that players would be able to practise associating these items that they see to the situations they use them, improving their memory of such objects.
Who is that?	Players must match names with the right faces Each correct pairing will add to the player's point total as long as the time given has not expired.	Similar to the Design Concept "Find it"	Players can add in facts or memories about the people whose faces are in the game to add a personal touch to the game as well as prevent such memories from being taken away by dementia
Happy or Sad?	Players must match descriptions of emotions with the right facial expressions	Similar to the Design Concept "Who is that?"	Players can add in people or things that help to trigger their memory recall

The team has come up with a systematic decision procedure when considering the components that should influence the choice of the decision concept. Such a procedure would ensure that:

1. Such a procedure prioritises the customer's needs

2. No criteria has been left out in the decision-making procedure
3. There will be a written record of the decisions made
4. In subsequent points of the development, justifications of decisions are possible

Because there is currently no cure for the memory loss associated with dementia, developing a game to provide dementia patients an avenue to exercise their cognitive function through practising memory recall will be the emphasis of this project.

Technology Consideration

For the development of the proposed web application, we will work with a modern JavaScript-based software stack that promotes reusability and maintainability.

The following key technologies have been identified -

Name	Component Type	Description
MongoDB	NoSQL Database	MongoDB is a free and open-source cross-platform document-oriented database program. Classified as a NoSQL database program, MongoDB uses JSON-like documents with schemata.
Node.js	Server-Side Framework	Node.js is an open-source, cross-platform JavaScript run-time environment that executes JavaScript code outside of a browser (for example, to run as a server).
Express.js	Web Application Framework	Express.js, or simply Express, is a web application framework for Node.js. It is designed for building web applications and APIs.
EJS Rendering Engine	JavaScript MVC Utility	EJS is a simple templating language that generates HTML markup with JavaScript.

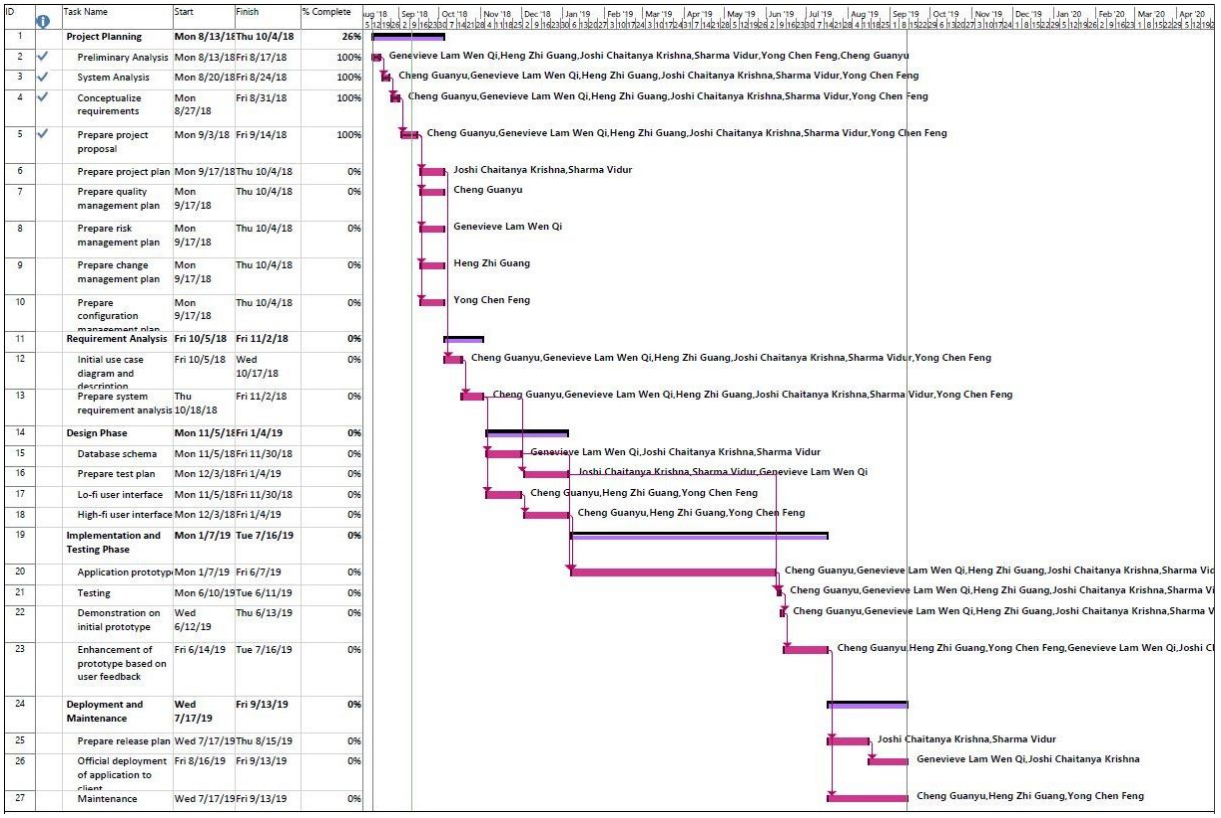
System Architecture

Our program will be structured according to the Model-View-Controller (MVC) system architecture. It divides the program into three interconnected parts for separating internal representation of information. Due to this, the code is modular.

1. Model represents the shape of the data and business logic. It maintains the data of the application and its object retrieve and store model state in the database.
2. A View is a user interface. View display data using model to the user and it also enables them to modify the data. Such representing elements in user interfaces includes buttons and display boxes.In web based MVC systems, a view can be implemented using a template that renders an HTML page. In our face matching game application, the Views would be the templates for rendering the login page, the matching page etc.
3. Controller handles the user request and translates them into actions that the Model should take. It renders the appropriate view with the model data as a response. In a web environment, this is usually done by having the Controller to handle incoming HTTP requests. It is possible to have more than one Controller in the application.

Using the MVC architecture allows the system to benefit from a separation of concerns and have loose coupling of various components.

Project Management



ID	Task Name	Start	Finish	% Complete
1	**Project Planning**	**Mon 8/13/18**	**Thu 10/4/18**	**26%**
2	Preliminary Analysis	Mon 8/13/18	Fri 8/17/18	100%
3	System Analysis	Mon 8/20/18	Fri 8/24/18	100%
4	Conceptualize requirements	Mon 8/27/18	Fri 8/31/18	100%
5	Prepare project proposal	Mon 9/3/18	Fri 9/14/18	100%
6	Prepare project plan	Mon 9/17/18	Thu 10/4/18	0%
7	Prepare quality management plan	Mon 9/17/18	Thu 10/4/18	0%
8	Prepare risk management plan	Mon 9/17/18	Thu 10/4/18	0%
9	Prepare change management plan	Mon 9/17/18	Thu 10/4/18	0%
10	Prepare configuration management plan	Mon 9/17/18	Thu 10/4/18	0%
11	**Requirement Analysis**	**Fri 10/5/18**	**Fri 11/2/18**	**0%**
12	Initial use case diagram and description	Fri 10/5/18	Wed 10/17/18	0%
13	Prepare system requirement analysis	Thu 10/18/18	Fri 11/2/18	0%
14	**Design Phase**	**Mon 11/5/18**	**Fri 1/4/19**	**0%**
15	Database schema	Mon 11/5/18	Fri 11/30/18	0%
16	Prepare test plan	Mon 12/3/18	Fri 1/4/19	0%
17	Lo-fi user interface	Mon 11/5/18	Fri 11/30/18	0%
18	High-fi user interface	Mon 12/3/18	Fri 1/4/19	0%
19	**Implementation and Testing Phase**	**Mon 1/7/19**	**Tue 7/16/19**	**0%**
20	Application prototype	Mon 1/7/19	Fri 6/7/19	0%
21	Testing	Mon 6/10/19	Tue 6/11/19	0%
22	Demonstration on initial prototype	Wed 6/12/19	Thu 6/13/19	0%
23	Enhancement of prototype based on user feedback	Fri 6/14/19	Tue 7/16/19	0%
24	**Deployment and Maintenance**	**Wed 7/17/19**	**Fri 9/13/19**	**0%**
25	Prepare release plan	Wed 7/17/19	Thu 8/15/19	0%
26	Official deployment of application to client	Fri 8/16/19	Fri 9/13/19	0%
27	Maintenance	Wed 7/17/19	Fri 9/13/19	0%

(Please use Gant Chart.pdf for larger version)

The project schedule has been structured into five main task phases for development. The five task phases are planning, requirement analysis, design, implementation and testing, and deployment. Each of the task phases is further divided into subtasks to monitor and control the development process of the project.

1. Project Planning:
    - Preliminary Analysis
    - System Analysis
    - Conceptualize requirements
    - Prepare project proposal
    - Prepare project plan
    - Prepare quality management plan
    - Prepare risk management plan
    - Prepare change management plan
    - Prepare configuration management plan
2. Requirement Analysis:

- Initial use case diagram and description
- Prepare system requirement analysis

3. Design Phase:
    - Lo-fi user interface
    - Hi-fi user interface
    - Database schema
    - Prepare Test Plan
4. Implementation and Testing phase includes:
    - Implement application prototype
    - Testing
    - Demonstration on initial prototype
    - Enhancement of prototype based on user feedback
5. Deployment and Maintenance
    - Prepare release plan
    - Official deployment of application to client
    - Maintenance

The requirements and objectives of the project have been fully evaluated among all the team members to provide a clear scope of the project. Due to time constraint, some of the tasks, such as designing of the user interface is done concurrently with the implementation of the application.

Deliverables

Project Deliverable	Estimated Deadlines	Stakeholders	Description
Project Proposal	13 Sept 2018	Project Committee	Problem statement, project objectives and system design are prepared in a document.
System Requirement Specification	20 Sept 2018	Project Manager Lead Developer Front-end Developer Back-end Developer	Identifying functional, non-functional and technical requirements. Those requirements are further analysed into detailed information.
Quality Management Plan	20 Sept 2018	Project Manager QA Manager QA Engineer	Problem reporting and corrective actions, software reviews and different controls are documented.
Project Plan	27 Sept 2018	Project Committee	Project schedule and key activities are established and documented.
Risk Management Plan	4 Oct 2018	Project Committee	Identifying and classifying risks and its impact. In addition, establishing the corresponding corrective actions to mitigate the impacts of risks.
Configuration Management Plan	4 Oct 2019	Project Manager Lead Developer Front-end Developer Back-end Developer	Configuration rules and controls are identified and documented.
Change Management Plan	4 Oct 2019	Project Committee	The change request process flow requirement and management log are identified and documented.
Test Plan	5 Jan 2019	Project Manager QA Manager QA Engineer Release Manager	Testing plan including UAT and SPT are created and documented. Test report is produced and corrective action is taken.
Prototype	6 June 2019	Lead Developer Front-end Developer	Initial prototype of the application

		Back-end Developer	
Demo	12 June 2019	Project Manager QA Manager QA Engineer Release Manager	Demonstrate the initial prototype and receive user feedback from client
Enhanced Prototype	15 Jul 2019	Lead Developer Front-end Developer	Improved version of the initial prototype. Changes are made based on user feedback.
Release Plan	15 Aug 2019	Project Manager QA Manager Release Engineer	Release approach and strategy are documented and launching of product.
Executable Code Module	1 Sept 2019	Lead Developer Project Manager Release Engineer	Deployment of the finalized application to the client.
User Manual	1 Sept 2019	Project Manager Lead Developer	Manual for the user to understand how to navigate the application

Budget

With a team of 6 members and a completion time of 12 months, the estimated budget required for this project will be $371,502. The amount is inclusive of a 1 year maintenance and support cost after the deployment of the project. In addition, a contingency cost estimated to be 10% of the Implementation Cost is being accounted for any unforeseen circumstances during the duration of the project.

The selection process involves communicating with the client regarding both the functional and non-functional requirements of the application. In addition, the monthly meeting with client and sponsors are also included in the selection process.

Ref	Project Expenditures	Rate ($ per Unit / Day)	Quantity (Units / No. of days)	Total
1.	**SELECTION PROCESS**			
1.1	Travel & Expenses	$30	30 (Subject to Gantt Chart)	$900
2.	**IMPLEMENTATION PROCESS**			
2.1	**Software Costs**			
2.1.1	Private Git Repository	$210 per month	12	$2520
2.2	**Hardware Costs**			
2.2.1	Servers	$350 per month	12	$4200
2.3	**Labour Costs**			
2.3.1	Project Manager	$5500 per month	12	$66000
2.3.2	QA Manager / Engineer	$5000 per month	12	$60000
2.3.3	Lead Developer	$4500 per month	12	$54000
2.3.4	Release Engineer	$4000 per month	12	$48000
2.3.5	Front-End Developer	$4000 per month	12	$48000

2.3.6	Back-End Developer	$4000 per month	12	$48000
3.	**CONTINGENCY**	10% of Implementation costs	-	$33162
4.	**MAINTENANCE COST** *(To keep the application live)*			
4.1	**Software (Private Git Repository)**	$210 per month	12 months	$2520
4.2	**Hardware (Server)**	$350 per month	12 months	$4200
	Total Costs			**$371502**

Communication and Coordination with Client and Sponsors

Bi-weekly update reports will be disseminated to the Client and Sponsors via email and phone calls by the project manager, if necessary. Additionally, monthly meetings will be held between the project manager, client and the sponsors to ensure the objectives are aligned.

The project manager will be the main point of contact to handle all the communications between client and sponsors to ensure greater efficiency and to minimise the chance of miscommunication. If necessary, individual team members may be called to the monthly meeting if their specific expertise is required. The bi-weekly update reports should be acknowledged across all parties (Development Team, Client & Sponsors) to minimise miscommunication.

Team Qualifications

Joshi Chaitanya Krishna (Project Manager): Chaitanya has a wealth of experience in managing international teams and delivering software systems based on cutting-edge R&D through previous stints at SAP Singapore and EPFL Switzerland. A team player, Chaitanya seeks to understand the goals of all his stakeholders to ensure the projects he handles are completed on time and to the satisfaction of all.

Genevieve Lam (Front-End Engineer): Genevieve has immersed knowledge in software engineering and specializes in crafting intuitive and human-centric interfaces. She has previously designed data-driven applications for A*STAR and Jones Lang LaSalle.

Vidur Sharma (Release Engineer): Vidur has handled deployment and release management for teams in OCBC Bank and Wood Mackenzie. His knowledge and presence of mind has always lead to successful deployments and having him on this team is truly a privilege.

Heng Zhi Guang (Lead Developer): Zhi Guang has lead and manage team of developers to deliver projects. He is able to split up the tasks and trust his team to follow project schedule. His leadership ensure that the projects delivered are according to the specifications and are of high quality.

Yong Chen Feng (Back-End Engineer): Chen Feng has participated in the development of high security back-end servers for a confidential project in ST Electronics. Coupled with his interest and knowledge in the field of Cyber Security, having him on the team will minimize and strengthen the vulnerability flaws in the application.

Chen Guanyu (QA Manager/Engineer): Guanyu has been a part of multiple teams of developers and collaborated with developers of different styles to bring various projects to fruition. His past experience in different projects will help him ensure that projects he is a part of can be completed smoothly.

Conclusion

All in all, we intend to construct a gamified application to help exercise the minds of dementia patients and monitor their advancement using their game score over time. This metric can then be used by the patient's guardian or specialist to measure the patient's treatment effectiveness and mental condition.

In light of the fluctuating symptoms of dementia and the extensive range of possibilities, we have chosen to concentrate the game on only one symptom – facial recognition – which is a common symptom found in dementia patients. This enables us to practice the resources of the mind that control reasoning and memory in a way that has not been done previously.

The application will be developed with the objectives previously outlined complemented with rigorous quality procedures to achieve a final outcome that will be straightforward, easy-to-use, instinctive, responsive and effective in the proposed timeline.

References

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Chaitanya Joshi

Final-year Computer Science undergrad, passionate about solving problems using Machine Learning and Data Science.

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EXPERIENCE

SAP Leonardo Machine Learning — *Research Intern*

JAN 2018 — JUNE 2018 | SINGAPORE

- Part of Cash Applications team to **automate accounting processes**. Built deep learning models for matching structured financial data.
- Improved system accuracy by 8% and reduced computation time by 99% from previous approaches. **Co-authored 3 patent applications**.

Laboratory of Artificial Intelligence, EPFL — *Research Assistant*

FEB 2017 — AUG 2017 and JUNE 2018 — AUG 2018 | LAUSANNE, SWITZERLAND

- Supervised by **Dr. Boi Faltings**, part of the chatbots group.
- Memory Networks and attention models for **personalization in neural dialog systems** (2017). Published at **NIPS 2017 Workshop**.
- Neural embedding models for **conversational information retrieval** (2018).

Evie.ai — *Machine Learning Engineer Intern*

DEC 2016 — JAN 2017 | SINGAPORE

- Worked on language understanding for Evie, an email-based **AI scheduling assistant**. Built and integrated deep learning pipelines for semantic role labelling and clustering.

PUBLICATIONS

1. **Chaitanya K. Joshi**, Fei Mi, and Boi Faltings. Personalization in Goal-oriented Dialog. ***Conversational AI Workshop, Advances in Neural Information Processing Systems (NIPS)*** (2017)

2. **Chaitanya K. Joshi**. Question-Answering and Chatbots using Memory Networks. Book chapter in ***Hands-On Natural Language Processing with Python. Packt Publishers.*** (2018)

SELECTED PROJECTS

- **Context News Bot:** Chrome extension using NLP to tackle fake news by providing contrasting perspectives from news sources to any tweet. **Winners at NUS Hack&Roll 2018.**

- **WriteOn:** Android app using image processing and reverse-engineered OCR to improve spelling and handwriting of children with learning disabilities. **Winners at SUTD WhatTheHack 2017.**

- **Contextual Word Embeddings:** Studied techniques to add context to word embeddings using bi-LSTMs and its impact on sentiment analysis. **More than 40 stars on Github.**

EDUCATION

Nanyang Technological University, Singapore

B.Eng. in Computer Science

AUG 2015 — MAY 2019 (EXPECTED)

GPA: 4.70 / 5.00

Dean's List (2015-16)

École Polytechnique Fédérale de Lausanne, Switzerland

Exchange Program

FEB 2017 — JULY 2017

GPA: 5.40 / 6.00

CO-CURRICULARS

IEEE NTU Student Branch

Vice President

AUG 2015 — JUNE 2018

Chief organizer of **iNTUition** (NTU's annual hackathon)

NTU Open Source Society

Vice President

AUG 2016 — JUNE 2018

TECHNICAL SKILLS

Languages: Python, Matlab, Javascript, Java

Research: Tensorflow, PyTorch, Keras, Pandas, Scikit-learn

Development: HTML5+CSS3, Django, Flask, Firebase, Vue.js

SELECTED COURSEWORK

Software System Design
Artificial Intelligence
Neural Networks
Natural Language Processing
Computer Vision
Convex Optimization

Genevieve Lam

Computer Science undergraduate interested in combining machine learning, data science and software engineering to solve real world problems.

Nationality: **Singaporean**

Email: **genandlam@gmail.com**

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LinkedIn: **genandlam**

EXPERIENCE AND PROJECTS

A*STAR — *Research Assistant*

JANUARY 2018 - PRESENT | SINGAPORE

- Working under Dr Huang-Dong Yan on deep learning techniques for multi-modal healthcare data.
- Distress Analysis Interview Corpus: Detecting depression from audio/video features using LDA topic modelling and deep CNNs.
- Emotional Chatbot: Capturing user's emotion based on chat and replying appropriately

Hackmasters — *Data Scientist Intern*

JULY 2017 - JANUARY 2018 | LONDON, DUBAI, NEW YORK, BERLIN

- Selected for NTU's 6-month startup immersion program with Hackmasters, a London-based startup specializing in rapid prototyping and piloting of deep technology (machine learning, blockchain, AR) for global clients.
- Dubai Ambulance: Cardiac arrest prediction pipeline from patient data using ensemble machine learning methods (random forest, gradient boosting, neural networks).
- Dubai Airport: Queue waiting time prediction system using neural networks and historic time series data.
- Dubai Airport FreeZone Authority: Prototype of blockchain systems and chatbots for a Future of Work study.
- Ernst & Young, London, New York, Berlin: Consultancy project titled Future of 2030. Prepared technical reports on the effect of new technologies on governments, companies and society.

Jones Lang LaSalle (JLL) — *Data Analyst Intern*

MAY 2017 - JULY 2017 | SINGAPORE

- Implemented regression models for optimizing workplace utilization and maintenance cost reduction. (Used Python, SQL, Pandas, Scikit-learn)
- Performed sentiment and topic analysis on employee feedback submissions. (Used Python, NLTK, TextBlob)

EDUCATION

Nanyang Technological University, Singapore — *Bachelor's Degree in Computer Science*

AUGUST 2015 - PRESENT

Singapore Polytechnic — *Double Diplomas in Financial Informatics & Accounting*

APRIL 2012 - MARCH 2015

PROGRAMMING LANGUAGES

Python, R, Matlab, SQL, VBA, Java, C++, Javascript, HTML, CSS, Swift

SOFTWARE SKILLS

Keras, Scikit-learn, Pandas, NLTK, Gensim, TextBlob, SAS VA, Tableau, MS Excel

RELEVANT COURSEWORK

Machine Learning, Neural Networks, Natural Language Processing, Algorithms, Data Structures, Software Engineering, Software System Design, Databases, Compilers, Object Oriented Programming

VIDUR SHARMA

(M): +65 9052 6284 (E): sharmavidur23@gmail.com

EDUCATION

Nanyang Technological University, Singapore **Aug 2015 – Jun 2019**

Bachelor of Engineering (Honours) in Computer Science with Double Minor in Business (Finance) and Economics

- **NTU Science and Engineering Scholar** – Full scholarship for undergraduate studies and living expenses
- **Cum. GPA: 4.23/5.00, Completed CFA Level 1 (June 2018)**

University of Waterloo, Canada **Jan 2017 – May 2017**

Study Abroad Program (Winter Exchange)

● **Sem GPA: 85%** (Financial Accounting, Principles of Economics, Computer Networks)

Delhi Public School, New Delhi, India **Mar 2001 – May 2015**

GCSE 'A' Level Equivalent

● **Graduated with 98.00% (A+ in English, Math, Physics, Chemistry and Computer Science)**

WORK EXPERIENCE

NTU Innovation Lab, Singapore **Jul 2018 – Present**

Power Trading – Undergraduate Research

- Building Agents for Power Trading Agent Competition (TAC): Developing Agents acting as retail brokers, using Artificial Intelligence and Game Theory strategies in a competitive simulation of future retail power markets, also implementing spot and forward price forecasting models through smart grid simulations for Wholesale, Tariff and Balancing Markets

Wood Mackenzie, Singapore **Jun 2018 – Present**

Commodity Research – Summer Analyst

- Building power demand models for SEA using generation mix by fuel types and sectors across regions by capacity deration and dispatch forecasting tools, facilitating in creation of commodity market reports and proprietary insights for clients.
- Analyzing solar energy trends and solar stack models while collaborating with GTM Research to develop consulting pitch decks for prospective clients; led hypothesis-driven discussion with team to develop insights and eventually presented findings to key client stakeholders.

OCBC Bank, Singapore **Aug 2017 – Dec 2017**

Wholesale Banking Technology – Fall Analyst

- Preparing monthly analytics reports for resource forecasting and control purposes through implementation of VBA code and custom spreadsheets to improve efficiency and drive change for transaction reporting; achieved 30%-time gains and systems deployed in Singapore, Malaysia and China across consumer banking products

Citibank, Singapore **Jun 2017**

Citi Banking 101 – Spring Analyst

- Selected for a three-week long foundation program within Global Markets: Sales & Trading, shadowed and interacted with Credit and FX Options Traders, salespersons and structurers. Pitched winning case presentation on the application of Artificial Intelligence in banking to Citi's Global FinTech Innovation Lab

LEADERSHIP EXPERIENCE & EXTRACURRICULAR ACTIVITIES

NTU Inter-Varsity Cricket – Vice Captain & Training Head **Aug 2015 – Present**

- **Reigning Champions** of Singapore University Games (SUniG) 2015-2017
- **1st Position** in the league of Singapore Cricket Association (SCA) Corporate League Division 1 2017/18

NTU Debate Squad – Senior Debater **Aug 2015 – Dec 2017**

- Representing NTU in multiple international competitions such as APU 2017 and Pro-Ams 2016 since 2015
- Led training programs (Attendance: 30+) in various topics driving performance and participation from more than 30 students across NTU and NUS

Programming Skills:

Python – Intermediate

- Able to use NumPy and Pandas for time-series analysis, and statistical analysis of commodity market trends. Possess clear understanding of aggregation, resampling, OHLC analysis, and plotting of financial market data using NumPy and Pandas stack.
- Clear understanding of unit-testing in Python and designing modular time-series analysis components that can be plugged into existing libraries. Experienced with using Git (Bitbucket) to manage projects in university setting
- Build forecasting programs using ARMA/ARIMA models for electricity prices, and did walk-through analysis on the models to prevent over-fitting to the data-set

YONG CHEN FENG

+65 9123 4567

Yong0193@e.ntu.edu.sg

Computer Science Undergraduate passionate in the field of Cyber Security. Looking to leverage and enhance my knowledge and experience in Cyber Security.

Professional Experience & Project

Web Vulnerability Auditing **Aug 2018 - Present**
Research Student

- Research on current trending vulnerabilities occurring in web applications
- Developed an application using Static Code Analysis to identify any security flaws in the source code of a given web application.

ST Electronics (Info-Security) **Jan 2018 – Jun 2018**
Developer Intern

- Involved in a 'SECRET' Confidential level Project.
- Front-end Development of a Window Application using XAML
- Back-end Development using .NET framework
- Database migration and maintenance
- Deployment of application to client

Education

Nanyang Technological University
Bachelor's Degree in Computer Science
Aug 2016 – Apr 2019 (Expected)

Singapore Polytechnic
Diploma in Computer Engineering
Apr 2011 – Apr 2014

Achievements

Project Competition at SEMICON University Program 2014
Winner

Social Engagement & Entrepreneur Award 2014
Winner

Technical Skills

Professional Certificates
Cisco Certified Network Associate (CCNA)

Programming Languages
C, C++, C# (Proficient), Java (Proficient)

Operating Systems
Kali Linux, Red Hat Linux, Debian Linux, Windows

HENG ZHI GUANG
+65-9789-9320 | hzhiguang_93@live.com

STRENGTHS SUMMARY & CAREER OBJECTIVE

An enthusiastic team player interested in new software technology research. Seeking to leverage acquired academic knowledge to effectively fill your software development role in your company.

EDUCATION

Nanyang Technological University, Singapore — Aug 2016 – Aug 2019
B. Eng. Computer Science

Nanyang Polytechnic — Apr 2011 – Apr 2013
Diploma in Information Technology

- GPA: 3.59/4
- Specialize in Geospatial & Mobile Innovation
- Top 3 Samsung App Challenge
- Year 1 Semester 1 Director List (Top 10%)

EXPERIENCE

Eli Lilly (Singapore) Pte Ltd
Software Developer Intern — Dec 2013 – Mar 2014

- Developed web application to be use within the company in different part around the world.
- Developed using VB.Net to allow project team leader to view all on-going projects by priority levels and assigning more team member to critical projects to increase efficiency and productivity of the team.

Nanyang Polytechnic, Samsung App Challenge
Mobile App Developer — Aug 2013 – Jan 2014

- Developed basic multiplayer mathematics arithmetic game using Samsung API to connect multiple android smartphones to challenge against each other.

SKILLS

Programming Language – Java(Intermediate), C++(Basic), C#(Intermediate), VB.Net(Intermediate), HTML(Intermediate), JavaScript(Basic), JQuery(Basic), CSS(Intermediate)
Software development frameworks – ASP.Net, J2EE
Database – MySQL, MongoDB
IDE – Eclipse, Microsoft Visual Studio, Android Studio, IntelliJ IDEA
Version Control – Git
Other skills – RESTful APIs, JSON, SQL, Android, Basic networking, PowerShell scripting

CHEN GUANYU
Phone: +65 9829 4392 | Email: gchen010@ntu.edu.sg

EDUCATION

Nanyang Technological University **Aug 2016 - Jun 2020 (Expected)**
Bachelor of Engineering in Computer Science

ACADEMIC PROJECTS

Nanyang Technological University
Subway Automated Order Machine
- Wrote a program to simulate a Subway Automated Order Machine for the module CZ3005 Artificial Intelligence

Nanyang Technological University
Movie Booking and Listing Management Application (MOBLIMA)
- Implemented a console-based application to automate the viewing and booking of movie tickets for the group assignment in the module CZ2002 Object Oriented Design & Programming

Nanyang Technological University
Random Activity Generator
- Programmed an Android application that suggests activities for users based on preferences that they have indicated for group assignment in the module CZ2006 Software Engineering

CO-CURRICULAR ACTIVITIES & COMMUNITY SERVICES

NTU Toastmasters Club **Aug 2016 – Apr 2017**
Member
- Attended weekly sessions to improve public speaking skills

National Cancer Centre, Singapore **Jun 2017 – Aug 2017**
Patient Guide
- Assisted in patient registration

National Heart Centre, Singapore **Aug 2018 – Aug 2018**
Patient Sitter
- Assisted nurses by monitoring identified patients who had a higher risk of falling
- Alerted nurses when such patients attempted to engage in activities that put them at risk of falling

SKILLS

Languages: English and Chinese
Programming Languages: C, C++, Java, Python, SQL, Javascript, PHP, MATLAB