

TUTOR NOTE Mark as On-time. Evidence provided via email.

by Ryan Morris

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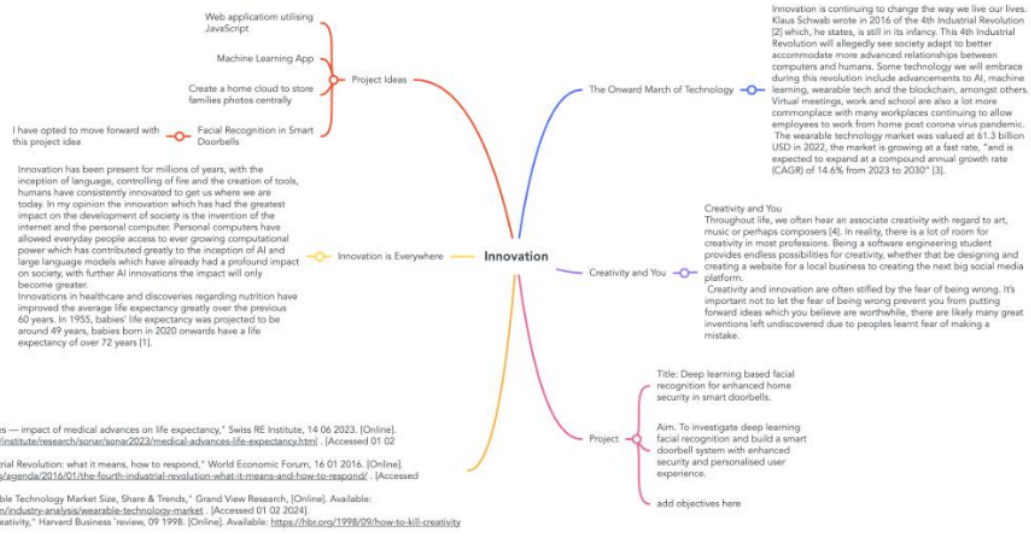
Changemakers

Thursday, 8 February 2024 14:34

Ryan Morris

Changemakers Assignment 1
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Task 1



Mind map created using mindmeister.

As a result of the mind map I have opted to select a deep learning based facial recognition application for use with smart doorbells.

Title: Deep learning based facial recognition for enhanced home security in smart doorbells.

Task 2

Q1.

Title: Deep learning based facial recognition for enhanced home security in smart doorbells.

Aim: To investigate deep learning facial recognition and build a smart doorbell system with enhanced security and personalised user experience.

Objectives:

- Research and Investigate:
 - Conduct a literature review on deep learning techniques for facial recognition.
 - Analyse existing smart doorbell systems and identify potential integration points for facial recognition.
 - Investigate ethical considerations and regulations surrounding facial recognition technology.
- Analyse:
 - Evaluate the feasibility and technical challenges of implementing a deep learning-based facial recognition system in a smart doorbell.
 - Analyse the trade-offs between accuracy, speed, and resource requirements for real-time facial recognition.
 - Assess the potential impact of ethical considerations on system design and implementation.
- Develop Proof of Concept:
 - Design a conceptual model for the smart doorbell system with facial recognition functionality.
 - Develop a simulated environment to test the feasibility and performance of the proposed system.
- Test:
 - Evaluate the accuracy of the facial recognition system using simulated data or a small-scale dataset.
 - Analyse the speed and efficiency of the system under various performance metrics.
 - Conduct user studies to assess the usability and acceptability of the proposed system design.
- Evaluate:
 - Summarise the research findings and identify key challenges and limitations.
 - Critically evaluate the ethical implications of using facial recognition technology in a smart doorbell system.
 - Recommend future research directions and potential improvements for the proposed system.

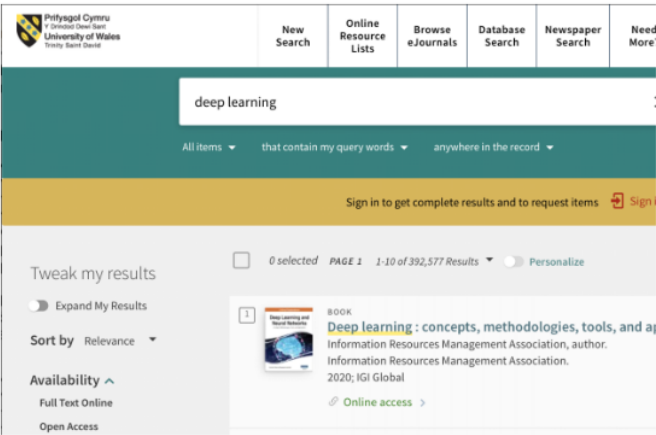
Q2. Research Philosophy

This project will utilise a mixed methodology approach, combining both positivism and phenomenology. I will utilise a positivism to research quantifiable data, such as the technical evaluation of my deep learning model to ensure accuracy and precision as well as to gauge the

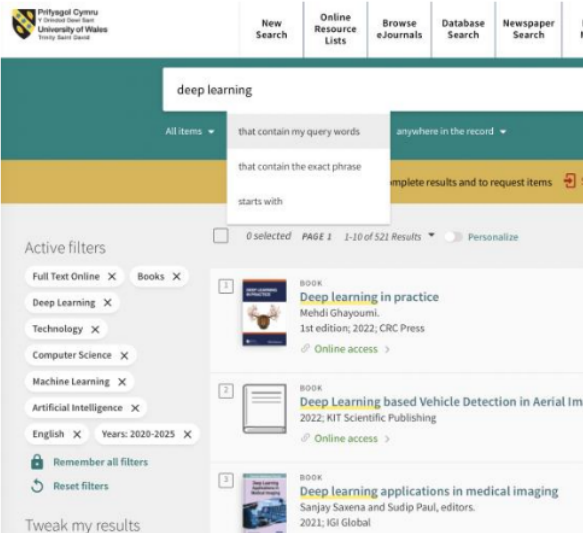
accuracy of the facial recognition portion of the system [1]. I will then utilise a phenomenological approach for the research, surveys and analysis of areas such as the user experience, perception and expectations as well as feedback on notifications and the users’ general sense of security fostered by the system. Using a phenomenological technique to gather information on these points will allow me to get a better sense of how the user feels about the system rather than just if it works or not [2].

Q3. Search Tools

For the research on this project, I am planning to primarily utilise UWTSD library website [3]. The UWTSD has filters on fields such as resource type, subject and creation date which are extremely useful in sifting out the information that I don’t need to see which can allow me to find resources necessary to succeed in this project. For instance, I have done a UWTSD library search for “Deep Learning” which I will need to research as part of my project, as you can see in the figure below, “Deep Learning” returns 392,577 results, which is unmanageable.



By selecting a few filters or ‘tweaks’ I have narrowed the search down to 521 results, which is much more manageable to look through. I will also add more key words to my search to narrow the selection down even more.



In addition to the UWTSD library, I will use Google Scholar, if necessary, which has similar search and filter options but occasionally will have texts which I am not able to access.

The IEEE xplore database has many resources relevant to my selected projected. I have found an interesting article on "Software architecture for the application of facial recognition techniques through IoT devices" [4]within minutes of searching, which I will read in detail upon commencing research.

Task 3

Q1.

To ensure sound research, I am going to first look into ways I can ensure my research will be valid, reliable, generalised and I will ensure I consider any ethical considerations. I plan to achieve these goals in the following ways:

Validity

To ensure validity I will:

- Conduct pilot testing prior to finalising the tests to sample with a small group of people. Pilot testing will help to highlight any potential flaws in my research methods and questionnaires, allowing me to refine my methods prior to finalising my research [5].
- I will identify relevant existing research on areas such as facial recognition and deep learning during my literature review. By identifying and reviewing similar research papers, I can compare the findings of my research to completed research papers, this will give me a baseline to which I can assess my research to see if it aligns with existing trends.
- To ensure validity, I need to ensure my research methods accurately measure what I need to measure. For the purposes of my project for example, I will ensure the facial recognition portion of my project has been thoroughly researched to ensure accuracy of faces detected.
- I will ensure to check data from multiple different sources in a triangulation approach to ensure I have a broad range of data which will encourage validity [6]. This will include my user surveys, research papers, observations and more.

Reliability

- One important aspect of ensuring reliability is the use of standardisation. Standardising any questionnaires so that the tests can be repeatable and the same from participant to participant. Standardisation should also apply to any tests I conduct, the tests need to be the same each time and be repeatable to ensure reliable data is collected. Standardising any questionnaires and tests reduced the risk of errors which may come about as a result of variations in methods.
- Conducting pilot testing is also a solid way to ensure reliability. Pilot tests will help assess research methods weaknesses or inconsistencies which can be rectified prior to the main research and questionnaires [5].

Generalisability

- To ensure generalisation I will ensure that I take a representative sample from my target demographic [7]. For a facial recognition security doorbell, this demographic will be anyone of moving out age up to the age of approx. 80 years old, of any gender. I will ensure I have a fair and even split of people from all ages within this range and genders to get the most general results possible. By getting as many users as possible within the target demographic to conduct my research on, I will further improve generalisation.
- I will also endeavour to perform tests on the various devices which the application is designed for to ensure the results of any testing are consistent across devices.

Ethical Considerations

- Consent will need to be received from all participants involved in my research, particularly those whose faces I use to test the deep learning facial recognition module.
- Storing any participants data will require secure storage, I will also anonymise data wherever possible.

Q2

Data Collection Methods

- For my selected project, I need to identify relevant data collection methods to gain valuable information which will help fine tune the final product.

Some data collection methods I will utilise are:

- Literature review
I will conduct an in-depth literature review of multiple up-to-date relevant information sources. The objective of the literature review is to give me a good understanding of the latest ideas and technologies used in the field of facial recognition and deep learning, as well as doorbell security technology. By gaining an in-depth understanding of all current information in these areas, I can direct my own research in a more streamlined and efficient direction [8].
- Survey
Surveys will play a key part in collecting user data which will help shape some aspects of my project. At least two surveys will be necessary, an initial kick off survey to confirm or challenge some aspects of my initial project vision. A second survey will be completed after the respondents trial the application. Although the overarching objective of accurate facial recognition through deep learning won't change, user feedback will help shape aspects such as user interface and general functionalities.
- Software Development and Testing
Developing a working application which has the basic functionality of the final project will allow me to conduct experiments and collect data which will give me good insight into the functionality of my project. By writing accurate tests which check all fundamental requirements I can accurately gauge the effectiveness of the application. A by-product of developing a working application is that it opens the door for more data collection methods such as observation.
- Observation/User Testing
By observing respondents using the application without interference, essential data can be collected. I will be able to observe how users interact with the application, the ease of finding crucial menu options, and the general user experience will be assessed [9]. Improvements will be made as a result of the observations.

Q3

Analysis

For my research project, I believe a combination of quantitative and qualitative analysis will give me a more rounded understanding of different parts of my project, such as, technical effectiveness and user experience.

- Quantitative Analysis
Quantitative analysis will allow me to analyse any numerical/categorical data I will collect as part of my surveys [10]. To collect numerical and categorical data I will ask questions such as "How would you prefer to receive notifications from your doorbell?" (section 3 question 1 of survey), a question such as this would have multiple choice answers, for example, mobile phone, tablet, or computer, and will provide categorical data. I plan to use visualisation such as bar or pie charts to understand how many users chose which device, this will allow me to tailor the user experience across popular platforms.
Using quantitative analysis on the percentage of correctly recognised faces is an essential metric to gauge the efficiency of the application. These tests will provide me with numerical data which I can analyse using descriptive statistics such as mean, median, standard deviation and box plots which will provide information on areas for improvement as well as accuracy. By creating tests which can be repeated on multiple versions of my application, I can have clear data to analyse and assess the current state of the software. Similarly, I will run tests on system performance, for example processing time and resource consumption to analyse usability and user experience.
- Qualitative Analysis
Alongside quantitative analysis, I will use qualitative analysis to help me understand the user perception and user experience [11] of the smart doorbell with facial recognition application. To collect data to qualitatively analyse, I have included an "Additional Comments" (section 4 of survey) question on my survey. I hope to discover patterns in user feedback in this section which I can utilise to discover patterns in user feedback about their feelings towards the app. Additionally, I will

consider interviewing candidates to collect data on how the users feel about the general concept of facial recognition in smart doorbells, including their overall comfort regarding the ethical/privacy considerations of facial recognition. By collecting data such as this and comparing it with data found in my literary review, I can have a more rounded understanding of how users feel about this potentially intrusive technology and tailor the software to satisfy any concerns, possibly including opt-out options or including clear data storage policies.

By comparing both my quantitative and qualitative findings, I endeavour to translate any user concerns or suggestions into actionable changes to create a final project that meets user expectations.

Kick-off Questionnaire

Deep learning based facial recognition for enhanced home security in smart doorbells

General idea: Have a smart doorbell which will recognise people. Users will be able to put a name to faces for personalised notifications. How long footage is stored can be tailored based on if the face is known/unknown (perhaps keep footage of unknown people longer for security purposes). Turn notifications on or off for certain people etc.

1) General Information

- What type of residence do you live in (e.g., house, apartment)?
- Do you currently own a smart doorbell?
 - Yes
 - No
- What features are most important to you in a doorbell? (select all that apply)
 - Video recording
 - Motion detection
 - Two-way communication
 - Night vision
 - Other (please specify)
- What age group do you belong to?
 - 18-24
 - 25-34
 - 35-44
 - 45-54
 - 55-64
 - 65+
- How comfortable are you with using facial recognition technology in your home? (select one)
 - Very comfortable
 - Somewhat comfortable
 - Neutral
 - Somewhat uncomfortable
 - Very uncomfortable

2) Security Preferences

- How important is home security to you? (select one)
 - Very important
 - Somewhat important
 - Neutral
 - Somewhat unimportant
 - Unimportant

- What are your biggest concerns regarding home security (select all that apply)?
 - Break-ins
 - Package theft
 - Loitering
 - Vandalism
 - Other (please specify)
- How would you feel about a doorbell that could identify familiar faces and tailor the alert you receive when unknown visitors approach? (select one)
 - Very interested
 - Somewhat interested
 - Neutral
 - Somewhat concerned
 - Very concerned

3) User Experience

- How would you prefer to receive notifications from your doorbell? (select all that apply)
 - Smartphone app
 - Tablet app
 - Computer app
 - Smart speaker announcement
 - Email
 - Other (please specify)
- If the doorbell identified a familiar face, what actions would you like it to take? (select all that apply)
 - Announce the visitor's name (if possible)
 - Display a live video feed
 - Allow two-way communication
 - Unlock the door (if applicable)
 - No action

4) Additional Comments

Please share any additional thoughts or feedback you have about a smart doorbell with facial recognition technology.

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FINAL GRADE

GENERAL COMMENTS

91 /100

Total:	91
1. Engagement with Literature Skills	
+ Good use of citations and references included.	20
2. Knowledge and Understanding Skills	
T1: + Good Knowledge and understanding of Unit1 topic 1 concepts, supported by citations. T2: + An appropriate research philosophy is defined and documented for the project. Supported by citations. T3: + Relevant research strategies for data collection are documented and selected. + Some different types of quantitative and qualitative analysis are outlined. + Linked to the project area. – Some additional methods could be documented. + Supported by citations.	18
3. Cognitive and Intellectual Skills	
T1: + Evidence of relevant concept and project idea analysis is documented. T2: + A single Aim and relevant Objectives have been documented. Good. T3: + Relevant strategies to enhance	20

validity, reliability, generalisability and ethical considerations are documented. + Related to the project area. + Supported by citations.	
4. Practical Application Skills	
T1: + Good use of software to create the Mind-map. Clearly structured. T2: + Appropriate research engines and a research database identified. – 1/2 additional research databases could be identified. + Search strategies used to identify relevant research related to the project area. T3: + Data collection method designed. – Not used to acquire some feedback to improve the focus of the project.	1 5
5. Transferable Skills for Life and Professional Practice	
+ Good format and clear presentation. + Citations and a reference list documented using a professional format. On-time/Late: OT.	1 8

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