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**Report Layout and Style**

A template will be provided on Moodle to support your work. However, the following guidelines **must** be adhered to:

* All **text will be black** in the report unless in very exceptional circumstance.
* Main body text must be at least **11pt font** using either **Arial or Calibri** font.
* Main body text will have **1.5 line spacing**.
* **Margins** will be a minimum of **2 cm on each side**.
* All **pages** will be **numbered consecutively**.
* **Figures** must have **captions** and be **numbered** (e.g., Figure 1).
* **Tables** must have **captions** and be **numbered** (e.g., Table 1).
* **Figures** may be **black and white**, or **colour**.

**Word Count**

There is a **10,000-word limit** for the project. Do not see this as a target, but rather a limit to the number of words we expect a project to have. All words in the main body, excluding words in figures and tables, will count to your word count. If you think you will go over 10,000 words, you should consider what can be removed from the main body and placed in an appendix.

**Copyright and Intellectual Property Rights (IPR)**

Your report should be written considering that it will be within the public domain. Normally, you retain copyright over your written work and Intellectual Property Rights (IPR) over any technical work. There are situations where this might not be as simple, for example when working with a company or on a larger university project. There are strategies you can utilise:

* You can inform your supervisory team that the project cannot be made available to other students undertaking an BSc Project.
* You can provide a shortened report for sharing that does not contain the protected information.
* You can assign IPR to the external collaborator, although you should take great care when doing so. It is best to speak to your supervisor.
* Non-disclosure agreements can be made between the external collaborator and the supervision team.

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Project Report Title

Subtitle if required

By

Abdel Ali Darib

Submitted to

**The University of Roehampton**

In partial fulfilment of the requirements

for the degree of

**BACHELOR OF SCIENCE IN COMPUTER SCIENCE**

Abstract

This report presents a project that aims to build an image generator for t-shirt designers using the state-of-the-art stable diffusion model from Stability AI. The stable diffusion model is a deep learning, text-to-image model that can convert text descriptions into detailed images. The project will use the stable diffusion model to create an user-friendly interface that helps designers generate artwork with ease. The project will also compare other AI generator user interfaces and integrate the DALL-E API to improve the user's ability to get the desired image. The report will cover the process of building the image generator, testing it, and comparing it with other AI generator user interfaces, as well as the results and conclusions of the project.

Signed (apply signature below)

**Declaration**

I hereby certify that this report constitutes my own work, that where the language of others is used, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of others.

I declare that this report describes the original work that has not been previously presented for the award of any other degree of any other institution.

**Date:** Enter the date here

**Enter your name here**

Acknowledgements

I would like to express my sincere gratitude to all those who have supported me throughout the completion of this project. Huge thanks to the team at Stability AI for providing access to the state-of-the-art stable diffusion model, which served as the foundation for this project. I would also like to thank the developers of the Printful, DALL-E and Replicate API for their assistance in integrating this tool into the project. I am also grateful for the guidance and support of my supervisor, who provided invaluable insights and direction throughout the project.

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# **Introduction**

## The Stable Diffusion model is a cutting-edge technology text-to-image generator that utilizes deep learning techniques to convert text descriptions into high-quality images. In this project, we aim to harness the power of this model to develop an image generator specifically tailored for t-shirt designers. The image generator will feature a user-friendly interface, making it easy for designers to generate unique artwork with ease. Additionally, we will integrate it with different API and compare the performance of our generator to other AI-based image generators available in the market. This report will detail the process of building and testing the image generator, as well as the results and conclusions of the project. The stable diffusion model offers a powerful solution for t-shirt designers looking to create unique and high-quality designs with minimal effort.

## Research Question or Problem that will be Addressed

How to use Stable Diffusion model to build an effective text-image generator with friendly interface for t-shirt designers?

## Aims

* Build an image generator using stable diffusion that helps a t-shirt designer generate artwork.
* Compare other AI generator user interfaces
* Integrate REPLICATE API to help user get their desired image

## Objectives

* Understanding the purpose of building text to image AI generator and how it works
* Point of view to other AI generator user interfaces
* Build an app using the stable diffusion model to convert text to image representing some examples
* Allow users to apply their generated images on the t-shirt template based on their description

## Legal, Social, Ethical and Professional Considerations

Risks:

* Integrating with Stable Diffusion model
* Producing a UI using Tkinter
* Testing the text-image generator
* Integrating with multiple API (DALL-E, Replicate, Printful)
* Test the Stable Diffusion model Using Google Notebook GPU

Ethics:

* Possibility of Using this model generator for illegal purposes
* Compliance with Terms of use for the models

## 

## Background

This project a suitable for a BSc because it addresses a real-world problem in the field of graphic design, and combines multiple areas of computer science, including artificial intelligence, user interface design, and image processing.

By using a stable diffusion model, the project aims to create a text-image generator that can produce high-quality designs while also being user friendly, making it a valuable tool for t-shirt designers. The application of AI techniques to the field of graphic design is an area of growing interest, and the successful completion of this project would demonstrate the student's ability to work with cutting-edge technologies and apply them in practical ways.

Overall, the project requires a significant amount of research and development, which is an important part of a BSc project. The student will need to evaluate existing algorithms, understand the limitations of existing solutions, and develop new methods to address these challenges.

## 

## Report overview

The report aims to build an image generator for t-shirt designers using a Stable Diffusion model and compare it with other AI generator user interfaces. The report will also integrate the REPLICATE API to allow users to get their desired designs include the objectives of understanding the purpose and workings of a text-to-image AI generator, evaluating other AI generator user interfaces, building an app using the stable diffusion model, and allowing users to apply their generated images on a t-shirt template based on their description.

The report will also address the legal, social, ethical, and professional considerations, including risks such as integrating with the stable diffusion model, producing a UI using Tkinter, testing the text-image generator, integrating with multiple APIs, and testing the model using Google Notebook GPU. On the ethical front, the report will consider the possibility of using this model generator for illegal purposes and compliance with terms of use for the models.

# **Literature or Technology Review**

The Stable Diffusion Model is a generative model that can be used for a variety of tasks, including text to image generation. The model takes as input a textual description and a set of random noise vectors and produces an image that matches the description.

In the case of the text-to-image generation models, various requirements need to be considered such as quality of generated images, model complexity, computational efficiency, and training data, the Stable Diffusion Model was chosen primarily due to the ability to generate high-quality images while being relatively easy to train compared to other models such as Generative Adversarial Networks (GANs).

Additionally, the Stable Diffusion Model allows for fine grained control and error analysis, over the image generation process, which is crucial for generating multiple images from a given textual description, making it suitable for practical applications.

The selection of a user interface technology for this project involves various factors such as ease of development, functionality, compatibility, and user experience. After a thorough evaluation for the text-to-image generation project of different user interface technologies such as Tkinter, PyQt, and Kivy, considering their strengths and limitations. Tkinter was chosen for the ease of use, and compatibility with the Python programming language. Tkinter is a standard Python library that provides a wide range of widgets and tools for creating user friendly interfaces, which means that it doesn't require any additional installation or configuration, making it an ideal choice for this project.

For the API Integration Technologies: The DALL-E API is used for generating images from natural language descriptions, while the REPLICATE API modifies existing images based on user description using a style transfer algorithm. The Printful API is used to print and ship custom images on products like t-shirts, posters, and mugs. The REPLICATE API was chosen because they provide powerful tools for generating high-quality, customizable images and converting them into physical products that can be delivered to the user.

**In addition, Google Notebook GPU provides powerful GPUs for machine learning and deep learning tasks. It is user-friendly and flexible, allowing users with faster image generation options based on their needs. While the Google Notebook GPU is an excellent option for many use cases, it may not be ideal for all scenarios. For instance, if the application does not require a significant amount of memory to function efficiently, a computer GPU may be more suitable. As are known for their reliability and stability, which makes them more dependable than cloud-based solutions that can be impacted by network connectivity problems.**

# **Design or Methodology**

GUIDANCE (text in blue can be deleted from your final submission)  
Now you must tell your examination team what you are going by answering the question -- **how are you going to undertake the project?**

The aim of this section is to explain to your reader the work you are going to undertake. Depending on whether the project is more build or research-focused, this section can take one of the following forms.

**Design** (for build or investigation-oriented projects)If your project is a build focused project, you should provide a design for what your project will build. The nature of this design will depend on your project, but it should provide a complete idea of what you are going to build, including the technologies to be used.

**Methodology** (for research or investigation-oriented projects)If your project is research-focused, then you need to define the particular research methodology you are using to gather and assess data. Typically, this will involve some sort of data gathering process and statistical analysis of results. However, you should also describe the tools (e.g., technologies) that you will use as well.

**Alternative Approaches**Another important point in this section is to document any alternative approaches you could have taken to complete the project. For example, were there different technology choices, design choices, or methodological choices you could have taken? You should explain why you have taken the approach you have taken rather than these alternatives.

# **Implementation or Results**

GUIDANCE (text in blue can be deleted from your final submission)

Once the examination team know what you planned to do, you must tell them what happened -- **What was the outcome of the work you undertook in the project?**

A build or investigative project will discuss the implementation. **Do not just paste in lines of code to your report and call that an implementation! Your report should feature minimum code to only discuss points.** The idea for implementation is to describe how the design has actually turned out.

A research or investigative project will present the results from performing the methodology. These results must be correctly presented, using appropriate tables, charts, and statistical tests that suit the nature of the project. Results should be summarised, and any findings clearly presented.

## Evaluation

GUIDANCE (text in blue can be deleted from your final submission)

The examination team now need to know how well the project went -- **How good was the outcome from the project?**

Evaluation is an important element of any project. You must tell your reader how good the final deliverable is. **Your project does not have to be perfect -- indeed the outcomes might have been bad.** The point is you must evaluate the outcome and discuss its strengths and weaknesses.

A key element of this section is a reflection on the aims and objectives set out at the start of the project, and how well these have been met. **Again, it is possible not to achieve an aim or objective.** The point is you evaluate how well you did meet your goals.

## Related Work

GUIDANCE (text in blue can be deleted from your final submission)

Answer the question -- **Who else has done something similar and how does my work compare?**

Another key element of this section is evaluating your work against that of others. How good is your work when compared to other people who have undertaken similar work? It is important to be able to understand how well you have achieved your goals in relation to others, while also considering the time limitations of the project.

# **Conclusion**

GUIDANCE (text in blue can be deleted from your final submission)

The conclusion summarises the project. You need to highlight your key outputs and/or discoveries. There are some particular subsections that must appear in your conclusion.

## Reflection

GUIDANCE (text in blue can be deleted from your final submission)

You must critically reflect on the entire project process and how well you have worked on the project. What particular things have you learned during the project? Why were you able and unable to meet project goals? What would have you done differently in hindsight?

A common approach many students take in this section is to claim poor time management. **Poor time management is rarely a problem unless you had too much to do in the project.** Normally, what is called poor time management is poor organisation, planning, and motivation. Being honest in your reflection will help you understand how you can improve these issues rather than focusing on time management issues.

## Future Work

GUIDANCE (text in blue can be deleted from your final submission)

Answer the question -- **What next?**

You've completed a significant piece of work -- perhaps the largest piece of work you have ever done. But no project is ever 100% complete, and you will have found new ideas along the way. If someone were to pick up your project, what avenues should be explored next?

# **References**

GUIDANCE (text in blue can be deleted from your final submission)

In this section, you **must** reference any sources used in your work. Typically, these sources will have come up during the investigation and related work sections. Your referencing must use the IEEE referencing style [IEEE Citation Guidelines2.doc (ieee-dataport.org)](https://ieee-dataport.org/sites/default/files/analysis/27/IEEE%20Citation%20Guidelines.pdf) .

It is **highly** recommended that you use reference management software such as Mendeley or Zotero.

Many students ask how many references are required. That is like asking how long a piece of string is. Your project should have as many references as is required for it. However, having few references indicates that no thorough investigation has occurred.

# **Appendices**

GUIDANCE (text in blue can be deleted from your final submission)

Appendices appear after references. Your appendices depend on the nature of your project. **Do not assume people will read your appendices.** Even if you direct them to do so in your main text, appendices are considered additional information and should not be relied upon to understand your main body of work. Refer readers to an appendix using a phrase such as *see Appendix A for further details*.

The following documents **must** be included as references:

* Your Project Proposal.
* Your Progress Review Form.
* Your original plan and revised plans as your project evolved.
* A description of how to access any technical output. **It is strongly recommended you use GitHub or something similar to do this.**

Any important communications between you and external stakeholders -- **please ensure private data is removed and communications anonymised.**