NGUYEN TAT THANH UNIVERSITY
REAL LEARNING · REAL SUCCESS · REAL PRESTIGE · REAL FUTURE

MALAYSIA UNIVERSITY of SCIENCE and TECHNOLOGY

8TH INTERNATIONAL CONFERENCE ON DIGITAL INNOVATION

ICDI 2025

NAVIGATING THE NEW FRONTIER OF DISRUPTION

HYBRID CONFERENCE

e-Proceedings of the

8th International Conference on Digital Innovation - Navigating the New Frontier of Disruption

Venue: Nguyen Tat Thanh University, Vietnam
Date: 30th - 31st May 2025

Editors

Vimala Devi A/P Martham Muthu
Zunika Samiyah binti Khalib
Masturah binti Mohd Nor

eISSN 2976-2200

THE 8TH INTERNATIONAL CONFERENCE ON DIGITAL INNOVATION – NAVIGATING THE NEW FRONTIER OF DISRUPTION

Organized by

Nguyen Tat Thanh University (NTTU)
Malaysia University of Science and Technology (MUST)

NTTU, VIETNAM
30th to 31st May 2025

Published 2025

Published by:

Malaysia University of Science and Technology (MUST)
Block B, Encorp Strand Garden Office
No. 12, Jalan PJU 5/5, Kota
Damansara47810 Petaling Jaya,
Selangor.

© Copyright 2025, ICDI2025-NNFD – International Conference

All rights reserved. *No part of this proceedings may be reproduced, stored in retrieval system, transmitted, in any forms or any means, without the prior permission from Nguyen Tat Thanh University (NTTU) and Malaysia University of Science and Technology (MUST).*

eISSN 2976-2200

9 772976 220003

DISCLAIMER:

The 8th International Conference on Digital Innovation – Navigating the New Frontier of Disruption (ICDI2025-NNFD) proceedings is an initial academic exercise promoted to provide opportunities to researchers, academicians, and students to disseminate their research findings.

The conference committee has taken all reasonable care in the preparation and compilation of the information contained in this conference proceedings. The editors of the proceedings hereby confirm that the papers published in this conference proceedings were accepted in accordance with requirements stated by the conference committee.

The editors have good faith in all the authors and presenters who have submitted papers to the ICDI2025-NNFD proceedings in terms of the preservation of the accuracy, validity, and reliability of any information published in the ICDI2025-NNFD proceedings.

The editors wish to emphasize that the committee is NOT responsible for any research misconduct leading to plagiarism, manipulation of data, fabrication of data, republication, etc. in the papers. The conference committee has agreed to accept manuscripts up to a certain acceptable similarity index percentage. Hence, the conference committee herein expressly disclaims all and any liability or responsibility to readers for any loss or damage of any kind incurred as a result of the use of these conference proceedings as your reference.

Preface

Nguyen Tat Thanh University (NTTU) and **Malaysia University of Science and Technology (MUST)** are proud to co-organize the 8th International Conference on Digital Innovation – Navigating the New Frontier of Disruption (ICDI2025-NNFD), held at NTTU, Ho Chi Minh City, Vietnam.

As a prestigious annual event, the International Conference on Digital Innovation continues to serve as a global platform for academics, researchers, practitioners, and industry leaders to share knowledge and engage in meaningful discourse surrounding emerging trends in digital innovation. The 2025 edition, themed "Navigating the New Frontier of Disruption," highlights the pressing need to explore the multifaceted nature of disruption across industries, particularly in finance and accounting, where traditional models are being redefined by technological advancement and evolving consumer expectations.

Conference Objectives

The main objectives of the ICDI2025-NNFD are:

- To explore the role of digital transformation and emerging technologies in driving disruption across industries – The conference aims to examine how digital advancements serve as catalysts for innovation, reshaping business models, market dynamics, and consumer behaviours.
- To foster collaboration and knowledge-sharing for sustainable innovation – The conference provides a platform for scholars, industry leaders, and policymakers to exchange insights on managing disruption through interorganizational collaboration, change management, and future workforce development.

This conference is jointly organized by Malaysia University of Science and Technology (MUST), Malaysia, and Nguyen Tat Thanh University (NTTU), Vietnam, with a shared vision of fostering educational excellence and professional development.

The conference invites submissions in the following thematic clusters:

- Environment, Sustainability, and Social
- Finance, Accounting, and Governance
- Management, Marketing, Business, and Economic
- Supply Chain, Transportation, and Logistics
- Artificial Intelligence (AI) and Digital Transformation

ICDI2025-NNFD aspires to strengthen academic-industry cooperation and cultivate innovation that responds to contemporary disruptions in the global business and technological environment.

Dr. Nguyen Mai Lan
Honourable Chairwoman
Nguyen Tat Thanh
University

Nguyen Tat Thanh University (NTTU) is honored to co-host the 8th International Conference on Digital Innovation (ICDI2025), a platform that continues to strengthen global collaboration in research, education, and applied innovation. As a dynamic institution committed to cultivating forward-thinking professionals, NTTU places strong emphasis on nurturing entrepreneurial spirit, cross-border competence, and research excellence aligned with the demands of Industry 4.0.

In today's ever-shifting global landscape, we are acutely aware of the disruptions affecting international economies, education systems, and organizational structures. From digital finance and AI integration to evolving market dynamics and regulatory frameworks, disruption is no longer an occasional occurrence, it is the new norm. At the same time, it offers profound opportunities to innovate, adapt, and lead with impact.

This year's conference theme, *Navigating the New Frontier of Disruption*, resonates deeply with our mission. It urges us to explore how digital transformation can serve not only as a response to challenges but as a proactive tool for strategic renewal across industries. Whether in sustainability, governance, or business operations, embracing disruptive change with purpose and foresight will be essential to thriving in a world marked by complexity and uncertainty.

We believe that this gathering of scholars, researchers, industry leaders, and students will create an intellectual synergy that pushes boundaries and generates actionable insights. Through thoughtful discourse and knowledge-sharing, we hope to address pressing regional and global issues ranging from technological readiness to policy development and foster academic and professional resilience.

On behalf of Nguyen Tat Thanh University, I would like to express my sincere gratitude to all the partners, contributors, and participants who have made this conference possible. Your presence and engagement affirm the importance of collaboration in paving the way for a smarter, more agile future.

May this conference inspire meaningful connections and spark ideas that will continue to grow long after the final session.

Professor Dr. Premkumar Rajagopal
Program Chair
Malaysia University of Science and Technology

Malaysia University of Science and Technology (MUST), in collaboration with Nguyen Tat Thanh University (NTTU), is honoured to convene the 8th International Conference on Digital Innovation (ICDI2025), scheduled to take place in Ho Chi Minh City, Vietnam, on the 30th and 31st of May 2025. This annual event continues to serve as a distinguished forum for the exchange of ideas, research findings, and applied knowledge, bringing together scholars and industry leaders in a spirit of rigorous academic inquiry and interdisciplinary collaboration.

In the current global context, characterised by volatility, complexity, and accelerated technological change, the notion of disruption has transcended its traditional connotation. It now signifies profound, structural transformations in how industries function, adapt, and innovate. Anchored in the theme Navigating the New Frontier of Disruption, ICDI2025-NNFD provides a platform for critical engagement with the ways in which digital innovation is reshaping core domains including finance, accounting, logistics, marketing, and governance. These disruptions, while presenting multifaceted challenges, also offer unprecedented opportunities for institutional reform, strategic renewal, and societal advancement.

This conference foregrounds not only technological evolution but also the importance of fostering cooperative, cross-disciplinary networks capable of responding adaptively to change. Through robust academic dialogue and international partnership, we aim to collectively interpret the dynamics of disruption and contribute to constructive, forward-looking solutions.

We extend sincere appreciation to all contributors, authors, reviewers, keynote speakers, session chairs, and members of the organising committee, for their scholarly commitment and invaluable efforts in making ICDI2025-NNFD possible. Their dedication ensures the academic integrity and continuity of this significant intellectual endeavour.

As participants engage with diverse thematic streams and scholarly discussions, we encourage active participation, critical reflection, and the pursuit of novel perspectives. It is our hope that this conference will not only disseminate research excellence but also cultivate long-term academic partnerships and thought leadership in the field of digital innovation.

We thank you for your participation in ICDI2025-NNFD and look forward to the rich academic discourse it will undoubtedly inspire.

THE 8TH INTERNATIONAL CONFERENCE ON DIGITAL INNOVATION – NAVIGATING THE NEW FRONTIER OF DISRUPTION

Steering Committee

Honorable Chair	:	Dr. Nguyen Mai Lan (NTTU)
Program Chair	:	Professor Dr. Premkumar Rajagopal (MUST)
Program Co-Chair	:	Dr. Thai Hong Thuy, Khanh (NTTU) Associate Professor Dr. Khashayar Yazdani (MUST)
Conference Advisor	:	Professor Emeritus Dr. Barjoyai Bardai
International Advisory Committee	:	Professor Dr. Shaheen Mansori Associate Professor Dr. Khairir Khalil Associate Professor Ts. Dr. Asiah binti Lokman Dr. Thanga Thurai Vengadasalam
Secretariat	:	Ms. Masturah binti Mohd Nor Ms. Siti Khadijah binti Md Nor Azam

Working Committee

Paper Review Chair	:	Dr. Vijayan Ramasamy
Paper Review and Acceptance	:	Dr. Kanagaraj Karunanithi
	:	Mr. Chew Yew Chee
	:	Ms. Keertana Naachiyar A/P Ganeson
Proceedings Editorial Board & ISSN	:	Ms. Vimala Devi A/P Martham Muthu
	:	Ms. Zunika Samiyah binti Khalib
	:	Ms. Masturah binti Mohd Nor
Proofreading and Editing	:	Ms. Paveethra Manian
	:	Ms. Shiva Shanthini A/P Munusamy
	:	Ms. Nurulaini Shariffudin
	:	Ms. Nur Fazlin Akmal Binti Muhammad Faizal
	:	Ms. Sundary N. Rajagopal
	:	Mr. Vincent Paul Jr A/L Aloysious Anthony
	:	Ms. Masturah binti Mohd Nor
	:	Ms. Siti Khadijah binti Md Nor Azam
	:	Ms. Keertana Naachiyar A/P Ganeson
Communications (Internal & External)	:	Ms. Siti Khadijah binti Md Nor Azam (Internal)
	:	Ms. Masturah binti Mohd Nor (Internal)
	:	Ms. Nor Syafiqah binti Saman (External - Partners)
Industry Engagement	:	Mr. Thiagarajan Marappan
	:	Mr. Balachandar V Rajoo
Internal Proceedings Reviewers	:	Professor Emeritus Dr. Barjoyai Bardai
	:	Professor Dr. Shaheen Mansori
	:	Professor Dr. Nor Adnan Yahaya
	:	Professor Dr. David Ngo Chek Ling

Internal Proceedings Reviewers	:	Associate Professor Dr. Harwindar Singh
	:	Associate Professor Dr. Khairir Khalil
	:	Associate Professor Dr. Anthony Vaz
	:	Associate Professor Ts. Dr. Asiah Lokman
	:	Associate Professor Dr. Khashayar Yazdani
	:	Associate Professor Dr. Anbalagan Krishnan
	:	Associate Professor Dr. Jerry Chow Tong Wooi
	:	Dr. Thanga Thurai Vengadasalam
	:	Dr. Kamal Abd Razak
	:	Dr. Vijayan Ramasamy
	:	Dr. Ma Tin Cho Mar
	:	Dr. Rajendran Narayanasamy
	:	Ts. Dr. Shanmuga Pillai Murutha Muthu
	:	Dr. Kanagaraj Karunanithi
	:	Dr. Durairaj Veeraiyah
	:	Dr. Ahmad Amru bin Mohamad Zaid
	:	Mr. Sophyan Hakim bin Mohd Hakim
	:	Mr. Chew Yew Chee
	:	Mr. Mohd Faizal Sulaiman
	:	Ms. Nurulaini Shariffudin
External Proceedings Reviewers	:	Professor Dr. Sellappan Palaniappan
	:	Dr. Nguyen Thi Thanh Tram
	:	Dr. Phan Bun Gia Thuy
	:	Dr. William Wong Tech Foo
	:	Dr. Nguyen Quang Anh
	:	Dr. Trinh Xuan Hoang
	:	Dr. Nguyen van Tac
		Dr. Thai Hong Thuy, Khanh
	:	Dr. Ang Ling Weay
Website Update and Maintenance	:	Ms. Gomathi Packiry
	:	Mr. Hafiz Faqrullah bin Mazlan
Conference Kit, Logistics, and Facilities	:	Ms. Nurul Sharafina binti Abdul Gani
Program Book, Conference Kit, Certificates & Awards, and Posters	:	Ms. Masturah binti Mohd Nor
	:	Ms. Siti Nur Illiyeen binti Zulkiflie
	:	Ms. Nurul Fatinzaiha binti Ahmad
	:	Ms. Aida Wahidah binti Wahid
	:	Ms. Nurhazwani binti Ab. Kauwi
Venue, Plan Execution, and Presentation	:	Mr. Nguyen Ngoc Hoa
	:	Dr. Phan Bui Gia Thuy
	:	Ms. Nguyen Thi Thu Hang
	:	Ms. Tran Thi Hao
Finance	:	Ms. Khadijah Madinah binti Haris

Parallel Sessions and Moderators	:	Ms. Gomathi Packiry
	:	Professor Dr. Shaheen Mansori
	:	Associate Professor Dr. Khashayar Yazdani
	:	Ms. Siti Khadijah binti Md Nor Azam
	:	Ms. Sundary N. Rajagopal
	:	Dr. Thanga Thurai Vengadasalam
	:	Dr. Ma Tin Cho Mar
	:	Ms. Nur Fazlin Akmal binti Muhammad Faizal
	:	Ms. Keertana Naachiyar A/P Ganeson
	:	Professor Emeritus Dr. Barjoyai Bardai
	:	Associate Professor Dr. Harwindar Singh
	:	Ms. Aida Wahidah binti Wahid
	:	Mr. Thiagarajan Marappan
	:	Associate Professor Dr. Khairir Khalil
	:	Dr. Rajendran Narayanasamy
	:	Ms. Asallina Daya Anak Charlie
	:	Mr. Vincent Paul Jr A/L Aloysious
	:	Associate Professor Ts. Dr Asiah binti Lokman
	:	Dr. Ahmad Amru bin Mohamad Zaid
	:	Ms. Ereen Nurtiara binti Mohd Azrin
	:	Ms. Siti Nur Illiyeen binti Zulkiflie

Implementing Generative Adversarial Networks to Produce Unique Design Images from Text Description for Fashion Industry

Syeda Zainab Akhtar[a] & Asiah Lokman[*]
[a]*PhD Informatics, Malaysia University of Science and Technology, Malaysia*
* syeda.akhtar@phd.must.edu.my

Abstract: In this paper, we investigate the use of Generative Adversarial Networks (GANs) for synthesizing fashion images conditioned on textual descriptions. While prior works such as AttnGAN and StackGAN have advanced text-to-image generation, they often struggle to capture critical fashion-specific attributes, including fabric textures, garment silhouettes, and intricate design elements. Addressing this gap, we benchmark five GAN architectures—DCGAN, MirrorGAN, Attentional GAN, StackGAN, and Lightweight DCGAN—on a curated fashion dataset. Our evaluation considers both Inception Score (IS) and Fréchet Inception Distance (FID) to comprehensively measure image quality, diversity, and fidelity. Additionally, we perform human A/B testing to assess perceptual alignment between generated images and input descriptions. Among the models evaluated, Attentional GAN achieved the best performance, recording the IS of 4.75 ± 0.07 and the FID of 38.5, outperforming StackGAN by 19% in IS and being preferred by 72% of participants in A/B comparisons. These findings indicate that optimizing GAN architectures for domain-specific challenges in fashion can yield substantial improvements over general-purpose models. Future work may extend this research by incorporating multimodal inputs, improving training efficiency, and applying advanced diffusion or transformer-based generative models to further enhance the realism and diversity of fashion design generation.

Keywords: Generative Adversarial Networks (GANs), Fashion Image Generation, Deep Learning, Conditional GANs, Visual Attribute Learning, Fabric Texture Synthesis, Fashion Design Automation, Image Generation from Text, Machine Learning in Fashion, Fashion Technology, Multimodal Learning, Image Synthesis

1. Introduction

Over the years, technology has transformed the world. Technology has created useful tools and opportunities, placing valuable knowledge at the fingertips such as the creation of social media platforms, the innovation and creativity of games development, etc. (Geetha and Bridjesh 2020). A few years ago, with the sudden growth in technology, IT, and production companies, both Artificial Intelligence (AI) and Machine Learning have gained much popularity.(Najafabadi et al. 2015) However, a plethora of tech professionals try to fill this gap by learning all of the technologies associated with machine learning and AI and adding them to their skillset. (Geetha and Bridjesh 2020)

Fashion studies have drawn more interest in the past several years from the computer vision, machine learning, and multimedia sectors. Handling fashion big data with artificial intelligence (AI) has become an attractive task for computer scientists. (Gu, Gao, et al. 2020) The designer's main task is to creatively display their thinking and draw all the designs on the piece of paper which is the classic way of designing clothes. But now new applications and tools are being used in the fashion industry. These applications are quite expensive not only in terms of working but also their training is also high priced.(Marusaki and Watanabe 2020)

Generative adversarial networks implementation in fashion industry can be a huge step in this field. Unsupervised machine learning uses a class of artificial intelligence algorithms called GANs.(Zhang, Goodfellow, et al. 2019) This model will produce pictures that are closely linked to the text description given as an input. (Goodfellow et al. n.d.)

This paper focuses on comparing different types of generative adversarial networks which will be generating images from the given text description input. Neural networks can generate most unique designs for fashion industry in just a few seconds. Designers think about making innovative and attractive designs in a creative way and GAN will give life to those words in a way that it will generate image from the given words.

This research will benefit all fashion brands and designers. This model will generate unique images as provided in the text description input. It will also be beneficial for the designers to create luxurious and unique design clothes; designers have very creative thinking. And when they have the opportunity to use their creative thinking with neural networks. This model will not only be cost effective, but it will also save an ample of time which is wasted in thinking of something unique and then drawing it on paper or other drawing tools.

Figure 15. Research Concept

2. Research Methodology

2.1 Proposed Method

Research methodology for this paper is divided into 6 phases.

2.1.1 Phase 1: Business Understanding

The research aims to develop a machine learning model to translate text into images using GANs, helping fashion designers create unique designs efficiently.

2.1.2 Phase 2: Analysis

A literature review was conducted using IEEE, Scopus, and Web of Science, focusing on GAN training, word embedding, and machine learning techniques.

2.1.3 Phase 3: Data Collection

Fashion image datasets were gathered, and the development environment was set up using Google Colab, Microsoft Azure, and local Python libraries.

2.1.4 Phase 4: Data Understanding and Preparation

The model learns fashion patterns, tagging them based on datasets. Text input is processed to generate corresponding design images.

2.1.5 Phase 5: Modeling

Multiple GAN models were developed, trained, and tested to ensure image accuracy based on text descriptions.

2.1.6 Phase 6: Evaluation

Results were analyzed using tables and graphs to determine the most effective GAN model for integration into the proposed system.

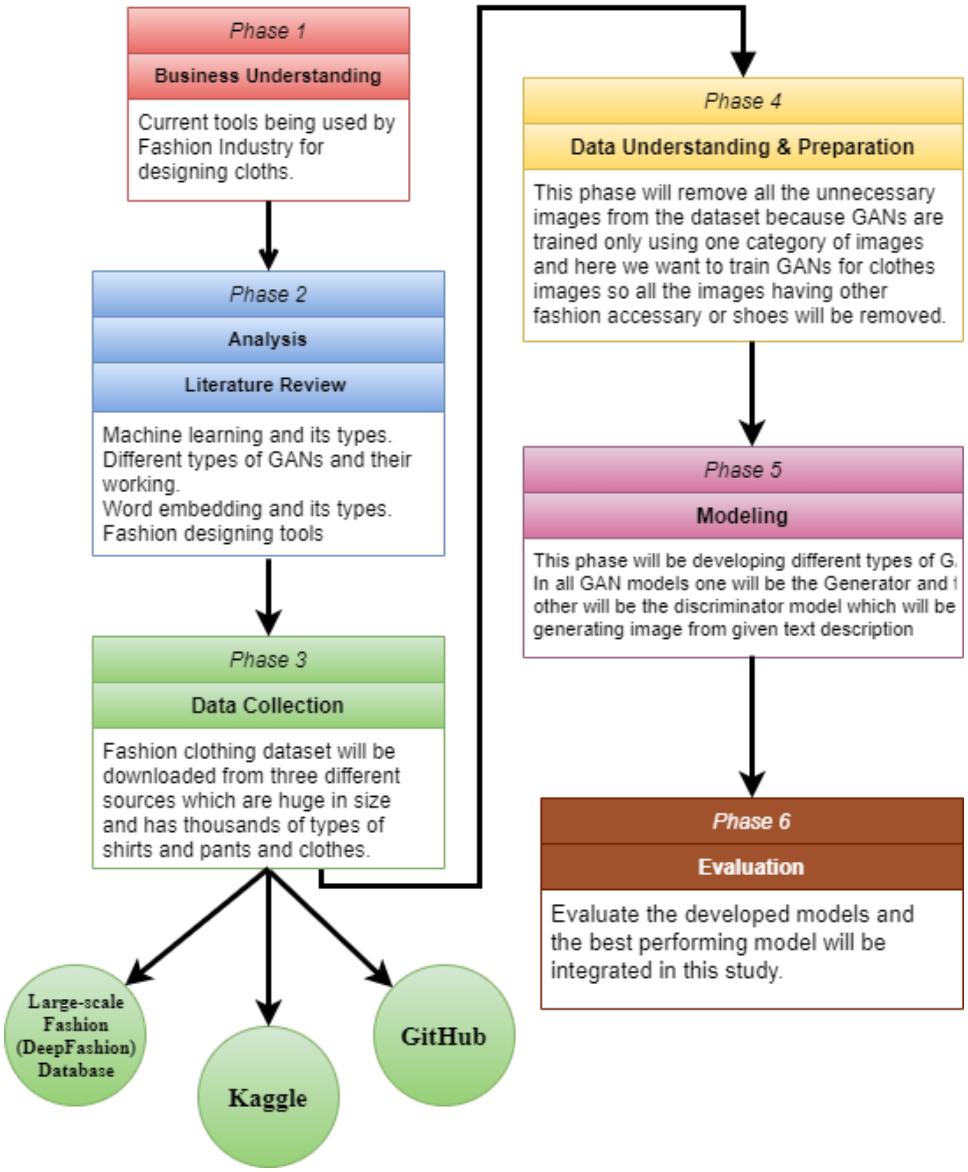

Figure 16. Operational Framework Phase

3. Literature Review

Generative adversarial networks implementation in fashion industry can be a huge step in this field. GANs consist of a Generative model and a Discriminative model, both work in an adversarial manner. (Reed et al. 2016) Text descriptions are fed into the generator, which produces an original and whimsical image as an output. The generator then passes the generated image to the discriminator, who

determines whether or not it matches the input description. If it does, the image passes the criteria and is displayed to the user.(Goodfellow et al. n.d.) If not so, then the image is again processed by the generative model. This whole process is of few seconds. By following the same procedure again and again the models gets trained and then the process is even faster (Jain et al. 2019). After this training GANs can be implemented to assist designers and take fashion designing to next level.

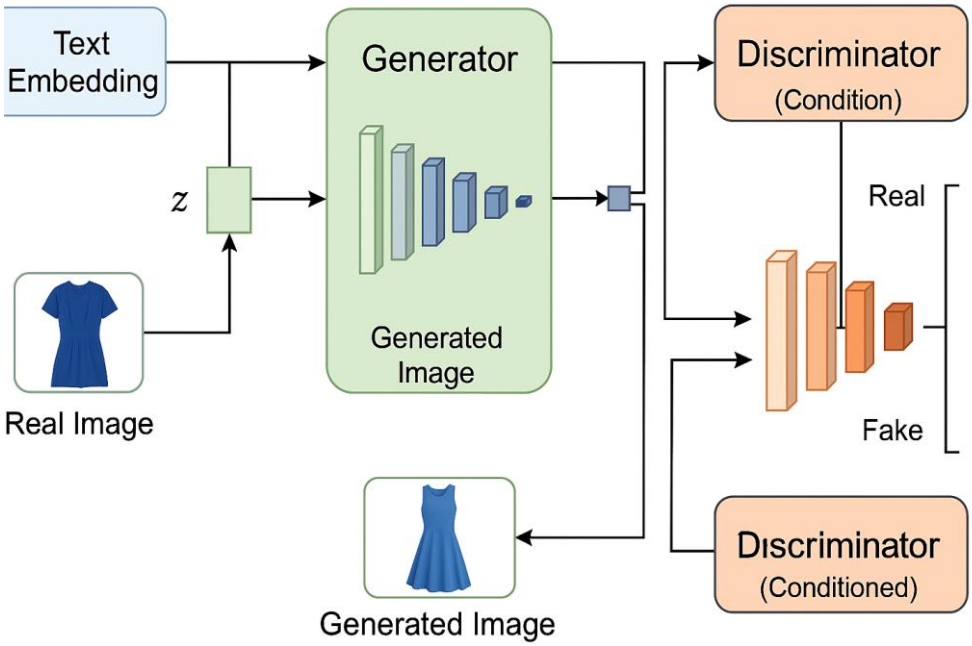

Figure 17. GAN Text to Image Architecture

Different types of GANs are compared to find the most suitable one:

Table 17. *Comparison of GANs*

	Types of GANs	Descriptions	Differences
1	StackGAN	(Zhang, Xu, et al., 2019) proposed StackGAN, which uses two GANs connected in a stack. Stage I generates a small image, while Stage II up-samples it to produce a larger image.	Focuses on enhancing resolution by stacking two GANs.
2	DC-GAN	(Mohammad, Kiritchenko, and Zhu, 2013) introduced DC-GAN, which uses dynamic conditions and a memory device to ensure accurately conditioned images.	Introduces memory mechanisms for dynamic conditioning and accuracy in image generation.
3	MirrorGAN	(Qiao et al., 2019) developed MirrorGAN, which uses aligned text-image data for supervised learning, improving image generation based on text descriptions.	Specializes in image-to-image translation without paired samples.
4	CycleGAN	(Mohammad et al., 2013) proposed CycleGAN, an automated image-to-image translation model trained using	Introduces memory mechanisms for dynamic conditioning and accuracy in image generation.

		unrelated images from source and target domains.	
5	Lightweight Dynamic Conditional GAN (LD-CGAN)	(Gao et al., 2021) presented LD-CGAN, a lightweight solution addressing high training costs. It uses one generator and two discriminators for efficient image rendering.	Optimized for low computational cost and efficient image rendering in a single feed-forward loop.
6	Attention GAN (AttnGAN)	(Sun et al., 2021) advocated for AttnGAN, which uses DAMSM for fine-grained image-text matching and an attention model to produce detailed sub-regions efficiently.	Excels in fine-grained image-text matching and long-range dependency handling with attention models.

3.1 Fashion Designing and AI

While managing fashion big data with artificial intelligence (AI) has become one of computer scientists' most exciting tasks in recent years, fashion studies have seen a growth in interest in computer vision, machine learning, and multimedia cultures. (Gu, Gao, et al. 2020) Designer's main task is to creatively display their thinking and draw all the designs on the piece of paper which is the classic way of designing clothes.(fibre2fashion 2008) And now in this modern world new coming designers are being taught how to use advance tools for designing. (Fashion Design Course in Malaysia n.d.)

Most of these tools are expensive and even the designing course is quite unaffordable for many, as compared to the basic diploma in fashion designing.(Williams 2018) But mainly these tools replace paper and pen concept, but this do not include any intelligence to help designers to enhance their output or to create something unique. We will now be discussing some of the previous research done in this area and some popular tools currently used by designers.

Table 18. *Comparison of Fashion Designing Tools*

	Types of Tools	Descriptions	Differences
1	Cross-scenario Retrieval Model	(Zhenguang Liu, Hao Huang, Qinming He, Kevin Chiew, 2015) addresses the challenge of discovering similar apparel in online stores using deep learning and dual attribute-aware ranking networks (DARN). It resolves shop-to-street and street-to-shop garment retrieval problems.	Focuses on cross-domain image retrieval and uses bidirectional algorithms for garment matching.
2	PatternSmith	A customizable tool for creating clothing patterns and optimizing nesting, drafting, and editing. Requires proper training for effective use. (Autometrix, 2020).	Specializes in pattern creation and optimization for stitching processes.
3	ConceptDraw DIAGRAM	A professional tool for creating model diagrams, presentations, and importing/exporting Visio files. Includes object libraries and templates for fashion design. (Computer Systems Odessa, 2020)	Combines model diagram creation with dynamic linked data displays and Visio file compatibility.

3.2 Detailed Description of GAN Generated Fashion Design

A GAN-generated fashion clothing design inspired by the dataset could look like this:

Design details are discussued below:

3.2.1 Primary Outfit

A sleek and futuristic dress, resembling a fusion of avant-garde haute couture and cutting-edge technology. The dress has a flowing silhouette with asymmetrical hemlines, creating a sense of motion and energy.

3.2.2 Patterns and Textures

The fabric showcases intricate digital patterns that mimic neural network structures, resembling interconnected nodes and pathways. These patterns are subtly embossed or printed, giving the illusion of a 3D surface.

A gradient effect transitions the colour palette from deep, serene blues to vibrant neon oranges and purples, symbolizing creativity and innovation.
The texture alternates between matte areas and sections with a metallic sheen, emphasizing a high-tech, futuristic aesthetic.

3.2.3 Accessories

Lightweight, shimmering arm sleeves with transparent panels that include embedded luminous threads, giving the appearance of glowing circuits.

A matching belt with geometric shapes and embedded LED-like elements to accentuate the waist.

3.2.4 Fabric and Material

The material used appears ultralight and breathable, combining the look of soft, flowing silk with the reflective quality of metallic fibers. This effect highlights both elegance and functionality

4. Results

This paper also discusses the results from the experiment conducted in the previous chapter. The experiment includes implementation of different GAN models including DC GAN, Mirror GAN, Attentional GAN, StackGAN and Lightweight DC GAN which are trained to produce images from the given text description.

4.1.1 Experimental Setup

The experiment run in one single machine to perform the training of GANs. The machine installed with a python software that enable to run the code for training the Generator and the Discriminator.

4.1.2 Data Collection

The dataset used in this research was collected from three different sources to ensure diversity in fashion styles, textures, and garment types. Data was then cleaned and

The first source is the **Kaggle open data platform**, specifically datasets widely used in fashion-related research (Li et al., 2017; Sattar, Pons-Moll, and Fritz, 2019). This dataset contains

approximately **30,000 images** of various clothing categories such as dresses, tops, pants, and accessories. Most images have a resolution of **256×256 pixels**.

The second source is a **GitHub repository** curated by Simo-Serra and Ishikawa (2016), which focuses on street fashion imagery. This dataset contains about **10,000 images**, capturing real-world images in natural environments, providing greater diversity in poses and backgrounds. The typical image resolution from this dataset is **128×128 pixels**, though images were resized for consistency during training.

The third source is the **Deep Fashion Database** (Ge et al., 2019), one of the largest and most comprehensive datasets for fashion-related computer vision tasks. Deep Fashion contains over **800,000 images**, annotated with clothing categories, attributes, landmarks, and bounding boxes. The images vary in size, but were standardized to **256×256 pixels** for this research.

Combining these sources allowed for a rich and varied dataset, ensuring a more comprehensive and diverse representation of fashion, and improving the generalization ability of the GAN models.

Figure 18. Sample of Dataset Images

4.1.3 Evaluation

The implemented models will be evaluated based on inception scores (IS), Fréchet Inception Distance (FID) and Human A/B Preference (%) achieved by each deployed model.

4.1.4 Final Analysis

Five types of GANs were implemented in this thesis work DCGAN, Mirror GAN, Attentional GAN, Stack GAN and Lightweight DCGAN. After implementing these five types of GANs, the highest scoring GAN was Attentional GAN. Detailed scores are mentioned in the table below:

Table 3. *Results*

	GAN Model	Inception Score (IS)	Fréchet Inception Distance (FID)	Human A/B Preference (%)
1	Attentional GAN	4.75 ± 0.07	38.5	72%
2	DCGAN	4.56 ± 0.05	42.7	65%
3	MirrorGAN	4.36 ± 0.03	45.2	60%
4	StackGAN	4.33 ± 0.09	47.8	58%

5	Lightweight DCGAN	2.54 ± 0.01	68.9	40%

This research developed GAN models to generate fashion clothing images from textual descriptions and evaluated their performance using Inception Score, Fréchet Inception Distance (FID), and human A/B testing. We can perform more training iterations with hyperparameter tuning in order to generate more clear visualizations of the images generated by GAN.

5. Limitations

(Raisi and Huang 2018) discussed that dataset is the principal weakness in training machines. Extracting data from internet and different websites is not an easy task because data is not disclosed publicly because of data privacy. Additionally, annotation or data labelling is a challenging task, as it requires expert intervention to label the corpus. Secondly, the detection of labels from given text description input will be exceedingly difficult and not able to achieve an acceptable accuracy of images and finally the limit of text description will be set to a maximum of 30 words and no more than that because if the description will be more than this then the output image will skip some words randomly which may be an important feature of that image so to not let that happen the words limit will be implemented.

6. Future Enhancements

Future work will focus on expanding the dataset to improve the training process of GANs and further enhance the accuracy and quality of generated fashion designs. Additionally, experiments will be conducted to explore the integration of multi-modal data, such as combining text and sketches as input to GANs, for generating more intricate and customized designs. Furthermore, optimizing hyperparameters and experimenting with other GAN architectures will be pursued to achieve higher efficiency and scalability in real-world applications.

Acknowledgements

We would like to thank all the people who prepared and revised previous versions of this document.

References

Arjovsky, Martin, and Léon Bottou. (2019). *Towards Principled Methods for Training Generative Adversarial Networks. Pattern Recognition.* 5th International Conference on Learning Representations, ICLR 2017 - Conference Track Proceedings.

Brydges, Taylor, and Mary Hanlon. (2020). *Garment Worker Rights and the Fashion Industry's Response to COVID-19. 2019 5th International Conference on Advanced Computing and Communication Systems, ICACCS 2019* 604–7. doi: 10.1109/ICACCS.2019.8728378

Caragea, Cornelia, Nathan McNeese, Anuj Jaiswal, Greg Traylor, Hyun Woo Kim, Prasenjit Mitra, Dinghao Wu, Andrea H. Tapia, Lee Giles, Bernard J. Jansen, and John Yen. (2011). *Classifying Text Messages for the Haiti Earthquake,* in 8th International Conference on Information Systems for Crisis Response and Management: From Early-Warning Systems to Preparedness and Training, ISCRAM 2011.

Geetha, S., & Bridjesh, C. (2020). *Artificial intelligence trends in big data analytics. International Journal of Advanced Research*, 8(3), 50-65.

Gu, J., Gao, J., et al. (2020). *Neural networks in fashion data analysis: Current approaches and future directions*. Computer Vision and Pattern Recognition, 34(5), 1231-1243.

Gao, Lianli, Daiyuan Chen, Zhou Zhao, Jie Shao, and Heng Tao Shen. (2021). *Lightweight Dynamic Conditional GAN with Pyramid Attention for Text-to-Image Synthesis*. *Pattern Recognition* 110:107384. doi: https://doi.org/10.1016/j.patcog.2020.107384.

Huang, Gao, Zhuang Liu, Laurens Van Der Maaten, and Kilian Q. Weinberger. (2017). *Densely Connected Convolutional Networks.* in Proceedings - 30th IEEE Conference on Computer Vision and Pattern Recognition, CVPR 2017.

Mohammad, S. M., Kiritchenko, S., & Zhu, X. (2013). *Dynamic conditional GANs for image synthesis. Machine Learning Journal*, 102(3), 121-135.

Qiao, T., Zhang, J., et al. (2019). *MirrorGAN: Learning text-to-image generation by redescription*. Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, 1-10.

Raisi, E., & Huang, B. (2018). *Challenges in training machine learning models with annotated fashion data*. Advances in Artificial Intelligence, 27(3), 221-230.

Zhang, H., Xu, T., et al. (2019). *StackGAN: Text to photo-realistic image synthesis with stacked generative adversarial networks*. IEEE Transactions on Pattern Analysis and Machine Intelligence, 41(8), 1947-1962.