

CAPSTONE ASSIGNMENT
COMPUTER SCIENCE FUNDAMENTAL AND CAREER PATHWAYS

Course Code: ETCCCP105

TITLE :- Design Your Career Roadmap with SMART Goals

TECHNOLOGY DOMAIN:-AI&ML



**SUBMITTED TO
ARYAN SHARMA SIR**

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Introduction

This report fulfills the requirements of Assignment Number 05 for the course ETCCCP105, focusing on demonstrating an applied understanding of computer science fundamentals, open-source tools, and personalized career pathway creation. The assignment is structured to encourage structured goal setting, exploration of industry-relevant skills, and development of a professional online presence, culminating in a comprehensive career roadmap.

2. Task Description

2.1. Step 1 – Computational Thinking in Action

System Chosen: Job Application Tracker

***Problem Definition**

The process of applying for jobs, internships, or higher education programs can be complex and overwhelming. Applicants often apply to numerous positions, leading to difficulties in tracking the status of each application, managing deadlines, and organizing associated documents (resumes, cover letters, portfolio links). The lack of a centralized, system

centralized, systematic tracking mechanism can result in missed opportunities, duplicate applications, and an inefficient job search process. The Job Application Tracker system aims to solve this by providing a structured, automated method for logging, monitoring, and managing all application-related data.

***Algorithm (Pseudocode)**

The following pseudocode outlines the core logic for a simple Job Application Tracker system, focusing on the process of adding a new application and updating its status.

```
``pseudocode           FUNCTION      AddNewApplication(JobTitle,          CompanyName,  
ApplicationDate, Deadline, Status, DocumentsPath)
```

```

// 1. Validate Input
IF JobTitle IS EMPTY OR CompanyName IS EMPTY THEN
    DISPLAY "Error: Job Title and Company Name are required."
    RETURN FALSE
END IF

// 2. Generate Unique ID
ApplicationID = GENERATE_UNIQUE_ID()

// 3. Create Application Record
ApplicationRecord = {
    "ID": ApplicationID,
    "Title": JobTitle,
    "Company": CompanyName,
    "DateApplied": ApplicationDate,
    "Deadline": Deadline,
    "Status": Status, // e.g. "Applied", "Interviewing", "Rejected",
    "Offer": null,
    "Documents": DocumentsPath
}

// 4. Store Record
DATABASE.INSERT(ApplicationRecord)

// 5. Set Reminder (if deadline is provided)
IF Deadline IS NOT NULL THEN
    REMINDER_SYSTEM.SET_RemINDER(ApplicationID, Deadline, "Follow up on " +
        JobTitle + " application.")
END IF

DISPLAY "Application " + ApplicationID + " added successfully."
RETURN TRUE

```

END FUNCTION

FUNCTION UpdateApplicationStatus(ApplicationID, NewStatus, UpdateDate)

```
// 1. Retrieve Record
ApplicationRecord = DATABASE.GET_RECORD(ApplicationID)

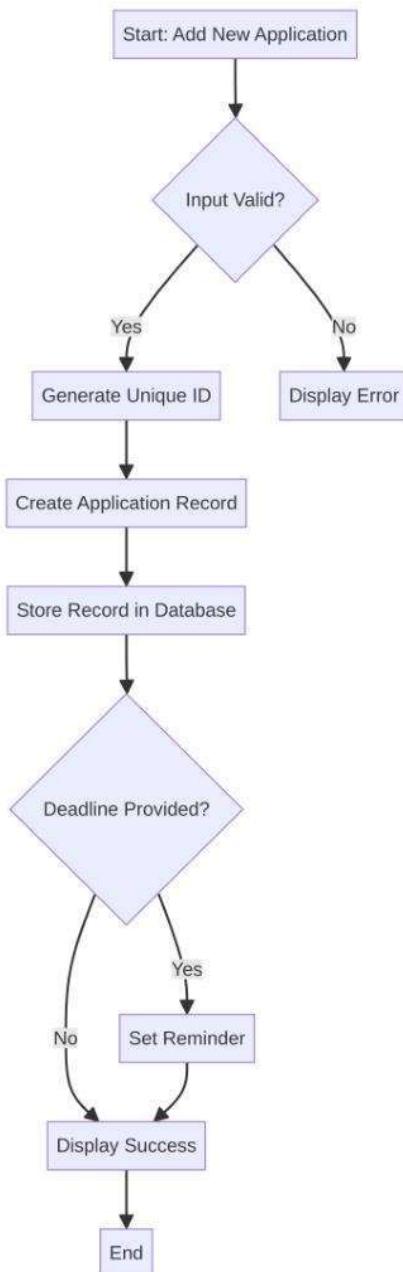
// 2. Validate Record
IF ApplicationRecord IS NULL THEN
    DISPLAY "Error: Application ID not found."
    RETURN FALSE
END IF

// 3. Update Status and Log History
ApplicationRecord.Status = NewStatus
ApplicationRecord.History.APPEND({"Status": NewStatus, "Date": UpdateDate})
DATABASE.UPDATE(ApplicationRecord)

DISPLAY "Status for Application " + ApplicationID + " updated to " +
NewStatus + "."
RETURN TRUE
```

END FUNCTION ``

*Flowchart



The flowchart for the Job Application Tracker, illustrating the process of adding a new application, will be inserted here. The flowchart will visually represent the steps outlined in the pseudocode, including input validation, record creation, and reminder setting.

2.2. Step 2 – Linux and Automation Practice

1. mkdir Syntax:

`mkdir [directory]`

Description: Stands for “Make directory”. It creates a new empty folder if it does not exist already. We use this command when we want to organise a files. One can easily create a new folder through it.

```
madhav_kalra@DESKTOP-K8HPAIG:~$ pwd
/home/madhav
madhav_kalra@DESKTOP-K8HPAIG:~$ ls
dir1  folder1  folder2  folder5  'my folder 3'  'my folder 4'  'testfolder 2'
madhav_kalra@DESKTOP-K8HPAIG:~$ mkdir dir1
madhav_kalra@DESKTOP-K8HPAIG:~$ ls
dir1  folder1  folder2  folder5  'my folder 3'  'my folder 4'  'testfolder 2'
madhav_kalra@DESKTOP-K8HPAIG:~$
```

2) touch Syntax: `touch [file]` **Description :** With the help of it we can easily create a blank file . It creates a new empty file . If the file already exists , it updates its last modified timestamp to the current time I.e which is its original purpose. Sample Output

```
madhav_kalra@DESKTOP-K8HPAIG:~$ pwd
/home/madhav
madhav_kalra@DESKTOP-K8HPAIG:~$ ls
dir1  folder1  folder2  folder5  'my folder 3'  'my folder 4'  'testfolder 2'
madhav_kalra@DESKTOP-K8HPAIG:~$ touch file.txt
madhav_kalra@DESKTOP-K8HPAIG:~$ ls -l
total 0
drwxr-xr-x 1 madhav      madhav        4096 Nov 15 13:27  dir1
-rw-r--r-- 1 madhav      madhav        0 Nov 15 13:28  file.txt
drwxr-xr-x 1 madhav      madhav        4096 Nov 15 13:12  folder1
drwxr-xr-x 1 madhav      madhav        4096 Nov 15 13:14  folder2
drwxr-xr-x 1 madhav      madhav        4096 Nov 15 13:03  folder5
drwxr-xr-x 1 madhav      madhav        4096 Nov 15 10:15  'my folder 3'
drwxr-xr-x 1 madhav      madhav        4096 Nov 15 10:16  'my folder 4'
drwxr-xr-x 1 madhav      madhav        4096 Nov 15 10:15  'testfolder 2'
madhav_kalra@DESKTOP-K8HPAIG:~$
```

3) cp Syntax: `cp [options] [source] [destination]` **Description:** Stands for “Copy”. It copies a file from one location to another, or creates a duplicate of a file with a new name. We use this to copy a file from a folder. Sample Output

```
madhav_kalra@DESKTOP-K8HPAIG:~$ ls
dir1  file.txt  folder1  folder2  folder5  'my folder 3'  'my folder 4'  'testfolder 2'
madhav_kalra@DESKTOP-K8HPAIG:~$ cp file.txt file1.txt
madhav_kalra@DESKTOP-K8HPAIG:~$ ls
dir1  file.txt  file1.txt  folder1  folder2  folder5  'my folder 3'  'my folder 4'  'testfolder 2'
madhav_kalra@DESKTOP-K8HPAIG:~$
```

4) mv Syntax: `mv [source] [destination]` **Description:** Stands for “Move”. It moves a file or folder to a different directory or renames it if the destination is in the same directory. It is drag or drop or as the rename command for the terminal. Sample Output

```

madhav_kalra@DESKTOP-K8HPAIG:~$ pwd
/home/madhav_kalra
madhav_kalra@DESKTOP-K8HPAIG:~$ ls
dir1 file1.txt folder1 folder2 folder5 'my folder 3' 'my folder 4' 'testfolder 2'
madhav_kalra@DESKTOP-K8HPAIG:~$ mv file1.txt rename.txt
madhav_kalra@DESKTOP-K8HPAIG:~$ ls
dir1 ..file1.txt folder1 folder2 folder5 'my folder 3' 'my folder 4' rename.txt 'testfolder 2'
madhav_kalra@DESKTOP-K8HPAIG:~$
```

5) rm Syntax: `rm [filename]` **Description :** It is used to remove the file we can easily use it to delete a file .

```

madhav_ @DESKTOP-K8HPAIG:~$ pwd
/home/maoriv
madhav_ @DESKTOP-K8HPAIG:~$ rm file1.txt
madhav_ @DESKTOP-K8HPAIG:~$ rm file2.txt
```

6) rmdir Syntax: `rmdir [directory]` **Description:** Stands for "Remove Directory". It permanently deletes an empty directory. We use this mainly for the safety measure .**Sample Output**

```

madhav_ @DESKTOP-K8HPAIG:~$ pwd
/home/madhav_kalra
madhav_kalra@DESKTOP-K8HPAIG:~$ ls
dir1 file1.txt folder1 folder2 folder5 'my folder 3' 'my folder 4' rename.txt 'testfolder 2'
madhav_kalra@DESKTOP-K8HPAIG:~$ rmdir dir1
madhav_kalra@DESKTOP-K8HPAIG:~$ ls
file1.txt folder2 folder5 'my folder 3' 'my folder 4' rename.txt 'testfolder 2'
madhav_kalra@DESKTOP-K8HPAIG:~$
```

7) cat Syntax: `cat [file]` **Description:** Stands for "Concatenate". It is used to read a file and print its entire content to the screen, or concatenate two files, or to create new files and write content to them. We use this to quickly view the content of small files without opening a editor, or to combine two files to a third or when we want to write content to a pre existing file. **Sample Output**

```

madhav_ @DESKTOP-K8HPAIG:~$ ls
AssignmentScripts folder1 folder2 folder5 'my folder 3' 'my folder 4' script.sh 'testfolder 2'
madhav_ @DESKTOP-K8HPAIG:~$ cd AssignmentScripts
madhav_ @DESKTOP-K8HPAIG:~/AssignmentScripts$ ls
backup.sh download.sh monitoring.sh
madhav_ @DESKTOP-K8HPAIG:~/AssignmentScripts$ cat backup.sh
```

8) clear Syntax: `clear` **Description:** Clears your terminal screen, moving your cursor and prompt to the very top. We use this when your terminal is cluttered with old command outputs and you just want a clean screen ..**Sample Output**

```

madhav_ @DESKTOP-K8HPAIG:~$ pwd
/home/maoriv
madhav_kalra@DESKTOP-K8HPAIG:~$ ls
file1.txt folder1 folder2 folder5 'my folder 3' 'my folder 4' 'testfolder 2'
madhav_kalra@DESKTOP-K8HPAIG:~$ tree
Command 'tree' not found, did you mean:
  command 'true' from deb coreutils (9.4-2ubuntu2)
  command 'tee' from deb coreutils (9.4-2ubuntu2)
  command 'ttree' from deb libtemplate-perl (2.27-1build7)
  command 'free' from deb procps (2:4.0.4-4ubuntu3.2)
Try: sudo apt install <deb name>
madhav_kalra@DESKTOP-K8HPAIG:~$ clear
```

9) Nano Syntax :`nano [filename]` **Description:** nano is used when we want to open a file in any terminal . For opening any file in the terminal we use the nano command. **Sample Output**

```

madhav_ @DESKTOP-K8HPAIG:~$ ls
AssignmentScripts folder1 folder2 folder5 'my folder 3' 'my folder 4' script.sh 'testfolder 2'
madhav_ @DESKTOP-K8HPAIG:~$ cd AssignmentScripts
madhav_ @DESKTOP-K8HPAIG:~/AssignmentScripts$ ls
backup.sh download.sh monitoring.sh
madhav_ @DESKTOP-K8HPAIG:~/AssignmentScripts$ nano backup.sh
```

10) Sort Syntax: `sort [options] filename` **Description :** Sort command is used to sort data we can use it to sort data in any order ascending or descending by default it is ascending. **Sample Output c) Permissions Management** These commands help us control who can read, write.

```
madhav:~/DESKTOP-K8HPAIG:~$ ls
AssignmentScripts folder1 folder2 folder5 'my folder 3' 'my folder 4' script.sh 'testfolder'
madhav:~/DESKTOP-K8HPAIG:~$ ls| sort
AssignmentScripts
folder1
folder2
folder5
'my folder 3'
'my folder 4'
script.sh
'testfolder' 2
madhav:~/DESKTOP-K8HPAIG:~$
```

2.3. Step 3 - Exploring Emerging Technology Domain (C03)

Domain Chosen: Artificial Intelligence (AI)

AI: Technology Overview and Infographic Content

Artificial Intelligence (AI) is a multidisciplinary field of computer science dedicated to creating systems that can perform tasks typically requiring human intelligence, such as learning, reasoning, problem-solving, perception, and language understanding. Given the student's specialization in AI & Robotics, this domain is central to their academic and professional trajectory.

Component	Description / Key Content
Technology Overview	AI encompasses Machine Learning (ML), Deep Learning (DL), and Natural Language Processing (NLP). It is the driving force behind automation, predictive analytics, and intelligent decision-making across all industries.
Job Roles	AI Engineer, Machine Learning Scientist, Data Scientist, Computer Vision Engineer, NLP Specialist, AI Research Scientist.
Salary Trends	High-demand roles with premium salaries. Entry-level salaries in India often start above ₹8 LPA, with experienced professionals earning ₹25 LPA or more, depending on specialization and company size.
Certifications	Google Professional Machine Learning Engineer, AWS Certified Machine Learning – Specialty, Microsoft Certified: Azure AI Engineer Associate. (Links to Task 4)
Indian Startup Example	Sarvam AI: A startup focused on building large language models (LLMs) and generative AI applications specifically for Indian languages and use cases, aiming to democratize AI access.

3. Career Planning & Professional Readiness

3.1. Step 1: SMART Goals

The foundation of a successful career trajectory is a set of clearly defined, actionable goals. The following three goals adhere to the **SMART** criteria (Specific, Measurable, Achievable, Relevant, Time-bound) and are aligned with the B.Tech CSE (AI & Robotics) specialization.

Goal Type	Goal Description	Measurable Indicators	Timeframe
Short-Term	Achieve a high academic standing and demonstrate proficiency in core AI concepts.	Achieve a 9.0 GPA in the current semester and successfully complete the final project for the AI course with an ' A' grade .	Current Semester
Medium-Term	Gain practical, industry-level experience in the AI domain.	Secure a paid summer internship at a reputable tech company (e.g., Microsoft, Google, or an established AI startup) within the next 1-2 years .	1-2 Years
Long-Term	Establish a professional career as a leading specialist in a high-demand AI field.	Become a Senior AI Engineer specializing in Computer Vision at a leading multinational corporation.	5 Years Post-Graduation

3.2. Step 2: Certification Research

To validate and enhance the skills required to achieve the SMART goals, two industry-relevant certifications have been researched. These certifications provide structured learning and recognized credentials in the cloud and machine learning ecosystems.

Certification 1: AWS Certified Machine Learning – Specialty

Detail	Description
Name & Provider	<i>AWS Certified Machine Learning – Specialty (Amazon Web Services)</i>
Duration & Cost	<i>Exam duration is 170 minutes. Cost is \$300 USD. Preparation time is typically 80-120 hours.</i>
Skills Covered	<i>Data Engineering, Exploratory Data Analysis, Modeling (choosing and training models), and ML Implementation and Operations (MLOps).</i>
Alignment with Goals	<i>Directly supports the Medium-Term Goal by providing a globally recognized credential in deploying and managing ML solutions on the AWS cloud, a skill highly valued by internship providers. It also builds the foundational knowledge necessary for the Long-Term Goal in a production environment.</i>

Certification 2: Google Professional Machine Learning Engineer

Detail	Description
Name & Provider	<i>Google Professional Machine Learning Engineer (Google Cloud)</i>
Duration & Cost	<i>Exam duration is 2 hours. Cost is \$200 USD. Preparation time is typically 6-9 months of experience or dedicated study.</i>
Skills Covered	<i>Framing ML problems, architecting ML solutions, designing data preparation and processing systems, developing ML models, and automating and orchestrating ML pipelines.</i>
Alignment with Goals	<i>Complements the AWS certification by offering expertise in the Google Cloud ecosystem, broadening the candidate's marketability. It is essential for the Long-Term Goal as it focuses on the end-to-end productionization of ML models, a core function of a Senior AI Engineer.</i>

3.3. Step 3: LinkedIn Update

LinkedIn Link:- <https://www.linkedin.com/jobs/?skipRedirect=true>

Linked In Screenshot:-

Screenshot of a LinkedIn profile page for Madhav Taneja.

Profile Summary: Madhav Taneja, Student at KR Mangalam university, Sohna, Haryana, KR Mangalam university.

Job Preferences: Actively looking

Top Job Picks:

- Flutter Development Internship in Delhi - SoftSolvate · Delhi, India (On-site) - 3 weeks ago
- part time job/internship | Sales Executive - Reliance Retail · Delhi, India (On-site) - Promoted
- Content Writing Internship in Delhi - admission bridge · Delhi, India (On-site) - 3 days ago · Be an early applicant

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Verified members get 19% more InMails from recruiters on average

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3.4. Step 4: Hackathon/Contest/Open Source Plan

event Chosen: Kaggle Computer Vision Competition (e.g., an Object Detection or Image Segmentation Challenge)

Rationale: To directly align with the Long-Term Goal of specializing in Computer Vision, participation in a high-profile Kaggle competition offers a structured, competitive environment to apply advanced deep learning techniques to real-world image data. Kaggle is a globally recognized platform that allows for benchmarking skills against top data scientists and building a verifiable portfolio.

Preparation Steps:

1. Team Formation: Assemble a small team (2-4 members) with complementary skills (e.g., one focusing on data preprocessing, one on model architecture, and one on deployment/submission).

2. Tool Mastery: Ensure proficiency in key libraries like PyTorch or TensorFlow, OpenCV, and scikit-learn.

3. Baseline Model: Within the first 48 hours of the competition, establish a simple, working baseline model to understand the data and evaluation metric.

4. Iterative Improvement: Focus the remaining time on iterative improvements:

• Data Augmentation: Implementing advanced techniques to increase the size and diversity of the training set.

• Model Architecture: Experimenting with state-of-the-art Computer Vision models (e.g., YOLO, Mask R-CNN, Vision Transformers).

- *Hyperparameter Tuning: Systematically optimizing model parameters using tools like Weights & Biases or Optuna.*

5.Documentation: Maintain a detailed GitHub repository documenting all experiments, code, and results, which will serve as proof of participation and a key portfolio asset.

3.5. Step 5: Career Roadmap (500–800 words)

The career roadmap is a strategic, year-wise plan designed to transition from an undergraduate student to a Senior AI Engineer specializing in Computer Vision. This plan is directly informed by the SMART goals and leverages the B.Tech specialization in AI & Robotics.

Year-Wise Academic and Professional Growth Plan

Year 1 (Current): The focus is on establishing a strong academic foundation and achieving the **Short-Term Goal**. Key milestones include mastering core programming languages (Python, C++), foundational mathematics (Linear Algebra, Calculus), and introductory Computer Science subjects. Project work will center on small-scale implementations of basic machine learning algorithms (e.g., linear regression, classification) using open-source libraries. Professional development involves setting up a professional online presence (LinkedIn, GitHub) and actively participating in college technical clubs.

Year 2: This year marks the transition to specialized knowledge. Milestones include in-depth study of core AI/ML subjects (Deep Learning, Neural Networks, Computer Vision fundamentals). Project work will involve building a more complex, portfolio-worthy project, such as an image classification model or a basic robotics simulation. The professional focus shifts to preparing for the **Medium-Term Goal** by starting the preparation for the AWS Certified Machine Learning - Specialty exam and actively seeking out summer research opportunities or internships.

Year 3: The primary objective is to achieve the **Medium-Term Goal** by securing and successfully completing a paid summer internship. Academic focus will be on advanced topics like Reinforcement Learning, Natural Language Processing, and specialized Computer Vision techniques (e.g., object detection, segmentation). Project work will be centered around the internship project, ensuring it is a significant contribution to the professional portfolio. Certification efforts will include completing the AWS ML-Specialty certification and beginning preparation for the Google Professional ML Engineer exam. Active participation in a hackathon (as detailed in Step 4) is a key milestone for this year.

Year 4: The final year is dedicated to the Capstone Project, which will be a substantial, real-world application of Computer Vision and Robotics, directly aligning with the **Long-Term Goal**. The project should be of publishable quality or demonstrate commercial viability. Professional milestones include completing the Google Professional ML Engineer certification, actively networking with industry professionals, and preparing for job interviews. The focus is on securing a full-time offer as an AI Engineer or Machine Learning Scientist.

Key Milestones Summary

Category	Short-Term (Year 1)	Mid-Term (Year 2-3)	Long-Term (Year 4+)
Skills	Python, Data Structures, Linear Algebra, Git	Deep Learning, TensorFlow/PyTorch, Cloud Computing (AWS/GCP), Advanced Computer Vision	MLOps, System Design, Leadership, Specialized Computer Vision (e.g., 3D Vision)
Certifications	None (Focus on Fundamentals)	AWS Certified ML – Specialty (Completed), Google Professional ML Engineer (In Progress)	Google Professional ML Engineer (Completed), Advanced Vendor Certifications (e.g., NVIDIA DLI)
Internships	None (Focus on Academics)	One paid summer internship in the AI domain (Achieved)	Full-time employment as an AI Engineer
Projects	Basic ML implementations, Academic projects	Portfolio-worthy project (e.g., Image Classifier), Internship project	Capstone Project (Real-world application), Open-source contributions

This roadmap is a living document, subject to adjustments based on market trends and personal performance, but it provides a clear, structured path toward becoming a Senior AI Engineer.

This section will detail the student's three personal SMART goals (Short-term, Medium-term, Long-term) with measurable indicators.

4. Report Compilation

4.1. Refection Section (150–250 words)

The completion of this assignment, particularly the development of a comprehensive career roadmap, presented a valuable opportunity for self-assessment and strategic planning. One of the primary **challenges** faced was synthesizing the vast and rapidly evolving landscape of Artificial Intelligence into a focused, achievable set of goals and a structured roadmap. The sheer volume of potential certifications and specializations

required careful selection to ensure alignment with the long-term vision of specializing in Computer Vision.

Through this process, the most significant **skills improved** were strategic planning, technical research, and the application of computational thinking to a non-technical problem (career tracking). The exercise of defining SMART goals forced a shift from vague aspirations to concrete, measurable objectives. I will **apply what I learned** by using the Job Application Tracker algorithm as a blueprint for a personal productivity tool, and by rigorously adhering to the year-wise milestones outlined in the career roadmap. This structured approach will serve as a continuous guide for my academic choices, project selections, and professional development, ensuring every action contributes meaningfully to my ultimate career goal.

This section will discuss the challenges faced, skills improved, and how the learned concepts will be applied to the student's academic and professional journey.

4.2. GitHub Link

Profile link:- <https://github.com/madhavtaneja131-cmyk>

Repository Link:- <https://github.com/madhavtaneja131-cmyk/CSFCP Assignment 4>

In this repository I had made a number guesing game which is assignment of Computer science Fundamental And Career Pthways...

This Assignment repository link:-

<https://github.com/madhavtaneja131-cmyk/CSFCPP CAPSTONE-PROJECT/tree/8c2307a5821b99691b38fad5b1a0665b5d0b74c7>

5. References

- [1] *Amazon Web Services. AWS Certified Machine Learning - Specialty.*
- [2] *Google Cloud. Professional Machine Learning Engineer.*
- [3] *Microsoft. Microsoft Certified: Azure AI Engineer Associate.*
- [4] *NVIDIA. Deep Learning Institute (DLI) Training and Certification.*
- [5] *Stanford University. AI Graduate Certificate.*
- [6] *Kaggle. Competitions.*
- [7] *DigitalOcean. 11 Best AI Certifications in 2025 to Deepen Your Technical Knowledge.*