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Immerse Education Research Journal

SPRING 2026 RESEARCH SYMPOSIUM WINNING PROJECTS
MEET THE WINNERS
TIPS AND RESOURCES
JUDGES COMMENTS

SPRING 2026 VOLUME 3 NO. 1
Transformative Educational Experiences

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About the competition

The Symposium celebrates excellence in research by high school students who have recently completed their Online Research Projects through Immerse Education.

The three shortlisted projects were chosen based on their:

- Quality and depth of research, including the use of relevant sources.
- Clarity, structure, and referencing of the written paper.
- The ability to clearly outline and summarise research and ideas.
- The ability to engage their audience with thought-provoking topics and detailed explanations of complex concepts.
- Support and guidance received from tutors as part of the research process.

Each shortlisted participant had the opportunity to present to a live audience. You can view their presentations here.

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Whether you take an accredited, classic or publication focused Online Research Programme, these virtual experiences offer an unparalleled opportunity for students aiming to refine their research and study skills ahead of university. The bespoke programmes stand out by allowing participants to immerse themselves in a subject of their choice, under the guidance of esteemed tutors from top institutions.

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- 8 dedicated sessions on research skills and essay writing
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- Choice of area of specialisation and focus to enhance research and study skills
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Tutor Profiles

Dr Aakashi Bhatt
Medicine

Dr Aakashi Bhatt MBBS, MS, MSc (Oxon), MCh, MPhil, DPhil (Oxon), is a General Surgeon specialising in Robotic Surgery. A top 1% MBBS graduate, she trained in India and completed an MSc and DPhil at Oxford, focusing on advanced genomic techniques for IVF and ovarian cancer research.

She has also been an Online Research Project and Academic Insights tutor for Immerse Education for several years, combining her passion for teaching with mentoring future medical professionals.

Laura Haas
Psychology, Law

Laura is a PhD candidate in Criminology at the Faculty of Law at the University of Oxford. Her doctoral thesis explores the effects of military experience on prison staff in the UK. One of her main areas of interest is the effect of PTSD on former armed forces personnel working as prison officers. She also explores the impact of military experience on prison staff culture, their identity, and their help-seeking behaviour and coping mechanisms.

Prior to her PhD, Laura completed two Masters - the MSc in Criminology and Criminal Justice at the University of Oxford and the MSc in Legal Psychology at the Medical School Berlin, in which she focused on sexual offending.

Laura has worked for Immerse since Summer 2022. In addition to working as an Academic Tutor for Immerse, she has also worked as an Associate Lecturer at Oxford Brookes University, teaching the Criminology modules “Theories of Crime” as well as “Dealing with Drugs”.

Testimonials

I found the Online Research Programme classes very interactive. I was able to work one on one with my tutor, which meant that I could ask the questions which I found most important, and allowed me to go more in-depth into what I was most interested in.

My tutor had economics experience from university, which meant that I was able to experience what studying economics at university would be like. I found it was very personal to me because it allowed me to go into my own interests rather than taking a course that would cover a whole variety of economics.

Shreya G

I'm planning on pursuing medicine and cell biology in both A-level and university, so the programme showed me what it would be like to be taught at a higher level.

I found it very surprising how helpful my tutor was and how accommodating they were. They explained a lot of things over and over, and especially in one-to-one sessions beforehand, you got quite a bit of time to ask them questions about what you didn't understand.

My tutor was very specialised in cell biology, which I found was very helpful because even in the lessons, if something wasn't mentioned, they were able to use their own knowledge and explain it, which I found was very interesting because I learned some extra things along the way, too.

Shrada G

Begüm Ogan

BEGÜM'S BIO:

Begüm is a 15-year-old Grade 9 student at Üsküdar American Academy in Istanbul, Turkey. She is passionate about artificial intelligence, particularly prompt engineering, and has a strong background in STEM. As a member of her robotics team, she participated in FIRST Robotics and helped the team achieve second place in the Galileo Division at the 2025 World Championship. She hopes to continue conducting research that supports the ethical development and application of AI technologies.

Prompt Engineering in Generative Pre-Trained Transformer Models

INTRODUCTION

Artificial intelligence (AI) consists of technologies that enable computers to perform complex tasks, including visual recognition, language comprehension and translation, data analysis, and making recommendations (Google Developers, 2024). AI models process and interpret different data types, such as images, text audio, and video by using advanced computational structures. Natural language processing (NLP) is a branch of AI that mainly helps generate human language in both written and spoken forms. With the increasing computational power, advancements in deep learning have made significant breakthroughs in the past couple of years. Large language models (LLMs), which utilise deep neural networks, represent the latest innovation in this field. These models process vast amounts of text data to well-structured outputs. Moreover, recent progress in LLMs has encouraged researchers to extend the usage of NLP, going beyond text-based tasks and combining them with vision, speech, and video processing (Han et al., 2024).

Generative pre-trained transformers (GPT) are considered one of the most prominent LLMs due to their ability to process vast amounts of data, capture complex patterns and generate human-like text with high fluency. They rely on transformer architectures to analyse and generate outputs.

However, despite their capabilities, GPT models still have their limits. They can produce biased, inaccurate, or misleading information and their responses heavily depend on the quality of input. Therefore, one key factor shaping GPT's effectiveness is the prompt which is the input or instruction given to the model to generate response. Prompts can take various forms, such as a question, a statement, or a command, and is designed to guide the model's output. The way we build our prompts heavily affects the model's response.

How we frame a prompt affects the AI's response. A well-designed prompt can improve accuracy, reduce bias, and enhance the overall quality of AI-generated content (Google Developers, 2024). Prompt engineering is designing prompts to maximise the accuracy and usefulness of AI-generated responses. Building the prompts includes processes of using various factors and strategies that help us get the most to-the-point result.

In this research, we will review the state-of-the-art AI language models, examine key factors influencing AI responses, and explore effective strategies for prompt engineering to improve AI-generated content.

2. AI LANGUAGE MODELS

2.1. LLM types

Popular LLMs include OpenAI's GPT-4 for text generation and conversation, Google's PaLM for reasoning and creative tasks, Meta's LLaMA for language understanding.

2.1.1. Traditional Language Models

Traditional language models, such as Google's search algorithm, help users find information by ranking web pages based on relevance. These models primarily retrieve and present information without generating new content. Transformer-based models use a layered structure to process text data efficiently. Figure 1 illustrates the main components of a transformer-based LLM.

The LLM blocks are as follow:

- **Input** is where raw data (text) enters the system.
- **Tokenisation** converts raw text into tokens (words, subwords, or characters) and prepares the data for further processing.
- **Encoder** processes the tokenised input through layers of self-attention and feed-forward networks, capturing complex relationships between tokens.
- **High-dimensional representation:** The encoder's output—a rich, multi-dimensional embedding that encapsulates the context and meaning of the input—is central to the model's understanding.
- **Decoder** utilises the high-dimensional representation (and additional context from previous outputs) to determine what token should be generated next.
- **Generate response** represents the iterative process within the decoder where the model constructs the output text. It is the action that transforms the learned representations into a coherent response.
- **Output** is the final assembly of tokens into human-readable text.

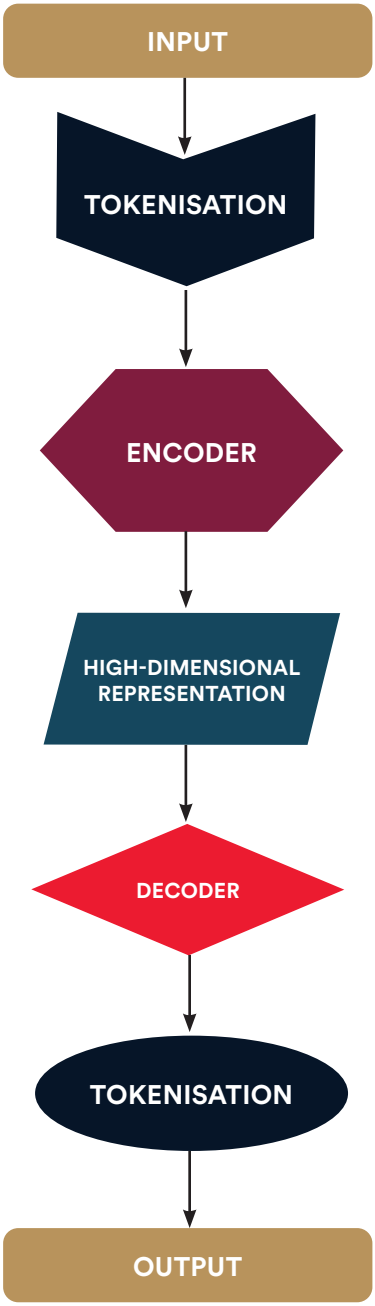


Figure 1. The structure and blocks of a transformer-based LLM.

2.1.2. Generative Pretrained Transformer (GPT) Models

OpenAI introduced GPT models as a breakthrough in natural language processing. Unlike traditional models, which rely on rule-based algorithms and predefined datasets, GPT models leverage deep learning techniques to understand and generate human-like text. Table 1 provides the evolution of ChatGPT models based on their size, tasks and features.

Model	Year	Size	Tasks	Features
GPT-1	2018	117M	Text generation, completion	First Transformer-based generative model
GPT-2	2019	1.5B	More advanced text generation	Zero-shot learning, better coherence
GPT-3	2020	175B	Chatbots, translation, summarisation, coding	Few-shot learning, high fluency
GPT-3.5	2022	~175B (Optimised)	Improved conversational AI	Faster, better instruction-following
GPT-4	2023	Estimated 1T+	Multimodal tasks, complex reasoning	More factual, image & text input

As can be seen, the improvements in ChatGPT models have been both rapid and efficient with a vast growth in model size and capabilities over just a few years. From 2018 to 2023, model sizes increased from millions to trillions of parameters, enabling advanced text generation, contextual understanding, and multimodal capabilities.

A significant breakthrough came with GPT-3 as this model. Before GPT-3, AI models needed a lot of training for each specific task, like translation or writing summaries. Unlike the previous models, GPT-3 could learn from just a few examples which is called few-shot learning (Brown et al., 2020)

3. PROMPT ENGINEERING IN GPT MODELS

3.1
Several key factors influence how GPT models interpret and respond to prompts, including specificity, context, and constraints. Specificity ensures that the model understands exactly what is being asked, as vague prompts can lead to unclear responses (Stanford University, n.d.). Context provides background information that helps the model generate more relevant answers, especially in multi-turn conversations or complex queries (Microsoft, 2023). Constraints define limits such as word count, tone, or format, guiding the model to produce responses that meet specific requirements (MIT Sloan, 2023). By carefully structuring prompts with these factors, users can optimise the accuracy, relevance, and effectiveness of GPT-generated outputs (ASU Career Catalyst, 2023).

3.2 Strategies

Effective prompt engineering enhances the performance of language models by improving clarity, relevance, and consistency in responses (Google Developers, 2024). Key strategies include giving clear and specific instructions, which help the model understand tasks precisely, and including few-shot examples, where providing sample inputs and outputs guides the model's response format. Adding contextual information ensures the model considers relevant background details, while using prefixes helps set the desired tone or style. Additionally, allowing the model to complete partial input generates more coherent and natural-sounding text. By applying these strategies, users can optimise AI-generated responses for greater accuracy and effectiveness (Google Developers, 2024).

3.3. Scientific Application

Due to the advanced capabilities of GPT language models, their application in scientific research has significantly increased in recent years. This applies to a wide range of fields, some of which will be outlined below.

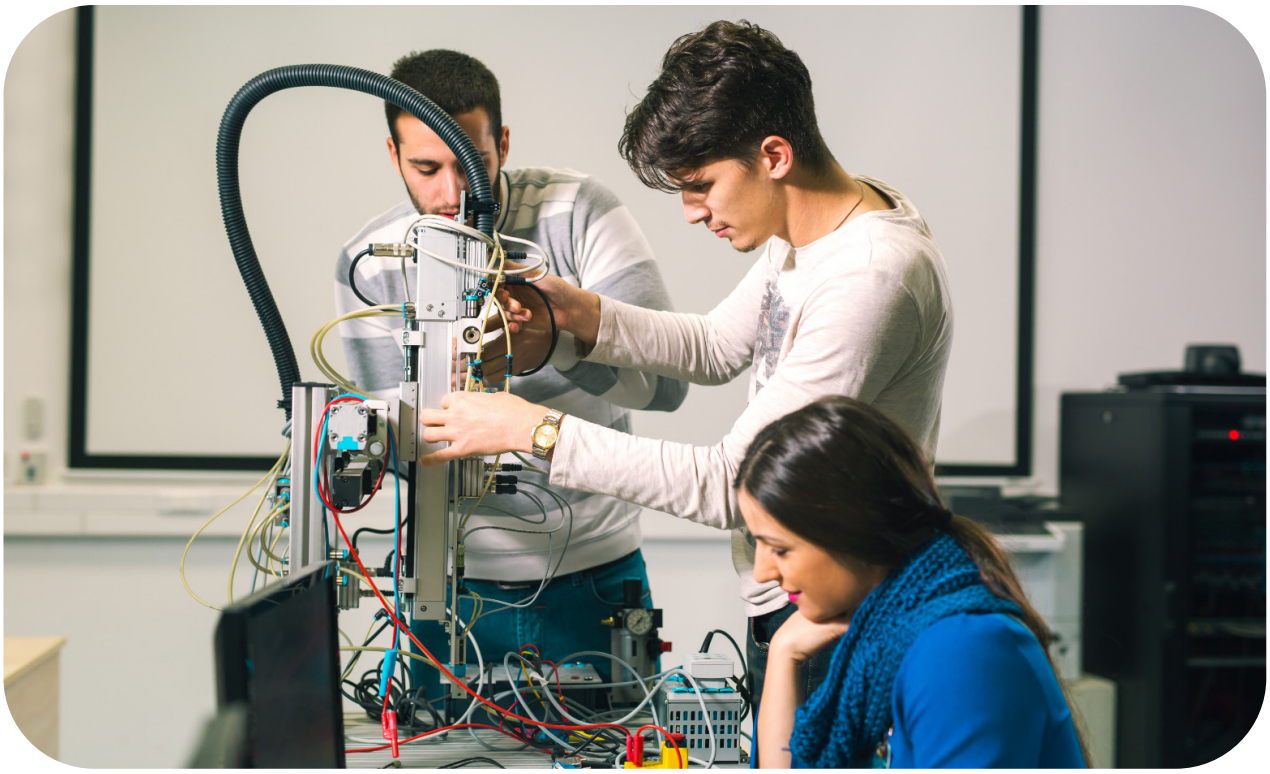
Computer Science/Software Engineering: Prompts are instructions given to automate processes and ensure specific output qualities. The paper presents a catalogue of prompt engineering techniques, describing how they solve common problems when conversing with LLMs (Schmid et al., 2023).
Higher education: The role of prompt engineering during interactions with AI in higher education is reviewed in (Dai & Xu, 2025), which leads to improvements in educational outcomes, including teaching and learning.
Healthcare: Practical recommendations for a wide range of healthcare professionals are presented to improve their interactions with LLMs (Köhle et al., 2023).
Image processing: Improving text prompts for AI models can enhance generating images from descriptions. The effective strategies for crafting prompts that lead to better visual outputs are identified in (Bansal et al., 2022).
AI Security: Prompt engineering techniques can bypass ChatGPT's safety restrictions. Various jailbreak techniques and their effectiveness on ChatGPT-3.5 and 4.0 were tested in (Shen et al., 2023). Results show that specific prompts can consistently evade safeguards, raising security concerns.

3.4. Prompt Security

Prompt security is critical to AI safety, focusing on guarding language models from harmful inputs that can manipulate their outputs. One effective defence mechanism is the Defensive Prompt Patch (DPP), which utilises strategically designed suffix prompts to prevent jailbreak attacks without significantly affecting the model's performance (Xiong et al., 2024). Additionally, the Signed-Prompt method involves signing sensitive instructions, enabling language models to distinguish trusted sources from potentially harmful ones, thereby enhancing security (Suo, 2024). These advancements highlight the need for strong security to protect AI systems from improper use.

4. CONCLUSION

In this paper, we reviewed the evolution of language models, focusing on AI-driven generative transformer models. We also explored the importance of prompt engineering in determining the quality of AI model outputs. Factors such as clarity, specificity, and constraints can affect the desired responses. Prompting strategies, such as structured approaches, step-wise and example-driven, can enhance performance in complex and large-scale language tasks.
The importance of prompt engineering extends across various scientific applications, e.g. healthcare, technology, security, etc. However, as GPT models evolve, most research remains qualitative. Future studies with a quantitative focus can help develop more effective strategies to optimise model responses and improve their reliability.



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JUDGE'S FEEDBACK:

It was a great pleasure to have Begüm Ogan as my student in the Artificial Intelligence accredited research programme at Immerse Education. The course began with an introduction to research skills, and based on her research interests, a topic was suggested that focused on the importance of prompt engineering in modern language models. Various examples of research skills were demonstrated using this topic. The skills covered in this course included familiarising students with the different types and nature of research, research planning, finding and using resources, analyzing information, structuring research, and proper citation techniques.

Her research interest was in language processing AI models, making prompt engineering for language models a suitable topic, given its popularity and recent advancements in AI. The project component of the course included both teaching materials and research content. She learned the fundamentals of AI, including artificial neural networks, deep learning, and machine learning concepts. She successfully built her own AI classifier and practically trained, compiled, and tested a deep learning-based model.

Begüm had an intermediate understanding of Python programming before starting the course but demonstrated rapid learning capabilities. She has a strong mathematical background, which she effectively applied throughout the course, particularly in complex AI concepts such as classification. This project's complexity is typically at an undergraduate university level, yet she successfully met all the objectives, producing a well-structured research essay.

Throughout the project, Begüm demonstrated impressive soft skills, including effective collaboration with her tutor, excellent time management, and efficient problem-solving to complete the tasks. Begüm is a bright and gifted student with a remarkable ability to grasp complex concepts quickly. I am confident she has a promising future and will be a valuable asset to any institution or research department she joins.

BEGÜM'S TIPS:

- Start with curiosity: Pick a topic that genuinely interests you. Passion will help you stay motivated when the research gets tough.
- Break the process into stages: From outlining to drafting, setting small goals helps you stay focused and avoid last-minute stress.
- Ask for guidance when needed. Whether you're unsure about a concept or need direction, don't hesitate to ask questions. Your tutor's experience is one of your best resources.
- Use diverse and credible sources: Using a variety of reputable sources will strengthen and add depth to your research.

Huanyin Ye

HUANYIN'S BIO:

Huanyin is a student with a strong passion for artificial intelligence. Through online research projects, he has developed key skills in critical thinking, academic writing, and structured investigation. He hopes to continue exploring the field of computer science and further develop his academic interests in the future.

Analysis of Sport Images Using Deep Learning Classification Models

INTRODUCTION

Artificial intelligence refers to the ability of humans to use machines and computers to simulate human thinking to solve problems, make decisions, and make judgments. According to Britannica, the three goals of artificial intelligence research are artificial general intelligence (AGI), applied AI, or cognitive simulation (Copeland, 2025). Machine learning is a branch of artificial intelligence research that focuses on developing algorithms for computers so that computers and machines can learn from data and be upgraded and iterated without human intervention. Research by IBM said: "Machine learning is the subset of artificial intelligence (AI) focused on algorithms that can 'learn' the patterns of training data and, subsequently, make accurate inferences about new data. This pattern recognition ability enables machine learning models to make decisions or predictions without explicit, hard-coded instructions" (IBM, 2025). Unlike hand-written code, machine learning models acquire information from data, allowing them to generalize to unknown situations.

Classification is a fundamental task in machine learning and data analysis, which involves learning from labeled training data, where the correct category of each example is known, and then using this knowledge to predict the category of new, unseen instances.

According to an essay on GeeksforGeeks: "Classification teaches a machine to sort things into categories. It learns by looking at examples with labels (like emails marked "spam" or "not spam"). After learning, it can decide which category new items belong to, like identifying if a new email is spam or not. For example, a classification model might be trained on a dataset of images labeled as either dogs or cats, and it can be used to predict the class of new and unseen images as dogs or cats based on their features such as color, texture, and shape." (GeeksforGeeks, 2025).

Deep learning is a type of machine learning algorithm that relies on learning to represent data. It focuses on enabling machines to extract and summarize features from data. It specializes in training artificial neural networks with multiple hidden layers (often referred to as deep neural networks). Amitha Mathew believes: "Deep learning is a class of machine learning that performs much better on unstructured data. Deep learning techniques are outperforming current machine learning techniques. It enables computational models to learn features progressively from data at multiple levels." (Mathew et al. 2020)

1.1. AIM AND OBJECTIVES

This project aims to compare different models for classifying images related to sports and find the best performance.

Objectives of this project are:

- Choose standard deep learning models with different structures and implement them for image classification.
- Train the models using a dataset containing images of various sports, and then validate their performance.
- Compare the accuracy of the models on the classification task to determine which performs best.

2. MATERIALS AND METHODS

2.1. Datasets

- We used ten classes of 100 Sports Image Classification from Kaggle. The dataset used in this study consists of color images obtained through internet searches. Figure 1 shows a few samples of the sport dataset.
  https://www.kaggle.com/datasets/gpiosenka/sports-classification/data

Figure 1. Samples of the sport dataset that are used in this project and their labels

The images are in JPG format and are 224×224×3 in size (contain red, green, and blue channels). The dataset contains 100 classes, each class is a type of sport, and we chose 10 classes from these. There are 14493 images, which are divided into three parts: train, test, and validation. Table 1 shows the number of data for each split. The training set is used for model learning, the validation set is used to adjust hyperparameters and prevent overfitting, and the test set is used to evaluate the final performance of the model on unseen data.

Split	Data samples
Train	13493
Test	500
Validation	500

Table 1. The number of samples and their distribution over the splits.

2.2. MODEL IMPLEMENTATIONS

Convolutional Neural Network (CNN) is a deep learning model for processing image information, automatically learning the features of objects from images. It was first proposed by Yann LeCun in 1998 as the LeNet model (Yann LeCun et al., 2002). This model was primarily used to recognize handwritten digits and was the first successful neural network applied to image recognition. Many improvements have since been proposed, such as VGG-Net (Simonyan and Zisserman, 2014), developed by the Visual Geometry Group at the University of Oxford. VGG features a deeper network (more layers) and uses many small 3×3 convolutional kernels, making the model more accurate in image classification. MobileNetV2 (Sandler et al., 2018) is a lightweight CNN architecture developed by Google and designed for mobile and embedded vision applications. It is widely used for tasks like image classification. Figure 2 shows the architecture of our proposed CNN classifier, which is a modification of the LeNet original architecture.

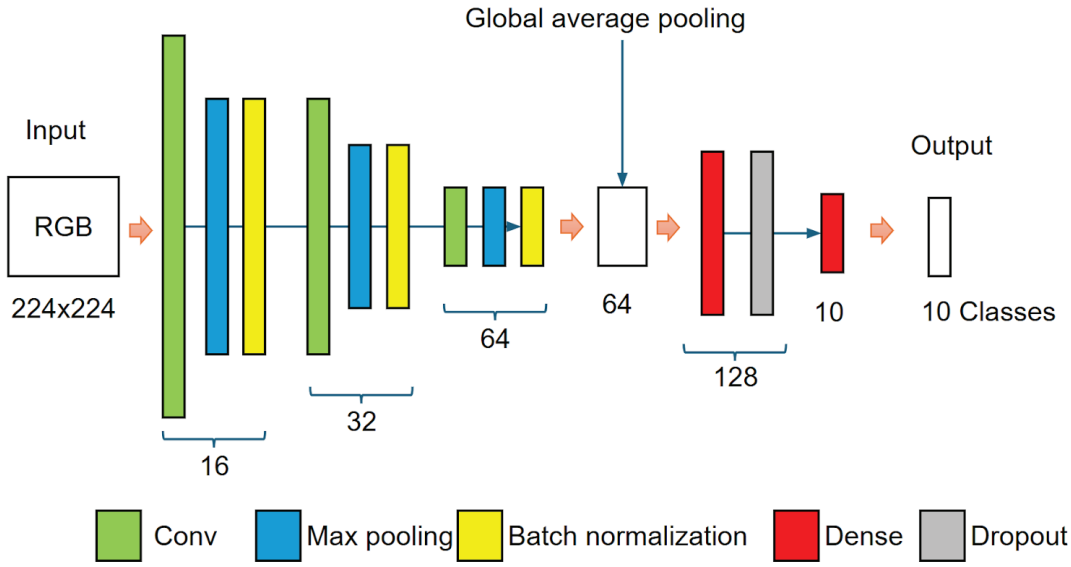

Figure 2. The architecture of our proposed CNN, which is a modification of the original LeNet.

We chose Python as the programming language because it has many extensive AI libraries and is easy to write. Because AI training requires a powerful GPU, we chose Google Colab as the compiler platform and utilized Google's cloud GPUs. For the code, we used TensorFlow (TensorFlow Developers, 2025) as the Python AI library because it supports both simple and complex neural network structures.

3. RESULTS

To accommodate the input requirements of different network architectures, we implemented distinct preprocessing strategies for each model.

- For the LeNet model, we used min-max normalization to rescale the original pixel values from the range [0, 255] to [0, 1]. This transformation helps accelerate convergence during training and effectively alleviates numerical instabilities that may arise from large input amplitudes.
- In the case of MobileNetV2, although the same min–max normalization technique was adopted, the pixel values were shifted and scaled to the interval [-1, 1]. This adjustment aligns with the original training protocol of the pre-trained MobileNetV2 model, thereby maintaining consistency in input distribution and enhancing the model's performance and stability during transfer learning.

https://colab.research.google.com/
https://www.tensorflow.org/

Table 2 presents the accuracy of each model for the train and validation splits. It also shows the training time for each model. Figure 3 shows the learning curves for all the models. It includes the accuracy and loss plot for training and validation datasets.

Table 2. Accuracy of each model and training time.

Classifier	Train Accuracy (%)	Validation Accuracy (%)	Training time (minutes)
Original LeNet	87.3	76.0	65
Modified LeNet	68.1	58.0	40
MobileNet	93.0	10.0	92
MobileNet + pre-train	98.2	100.0	38

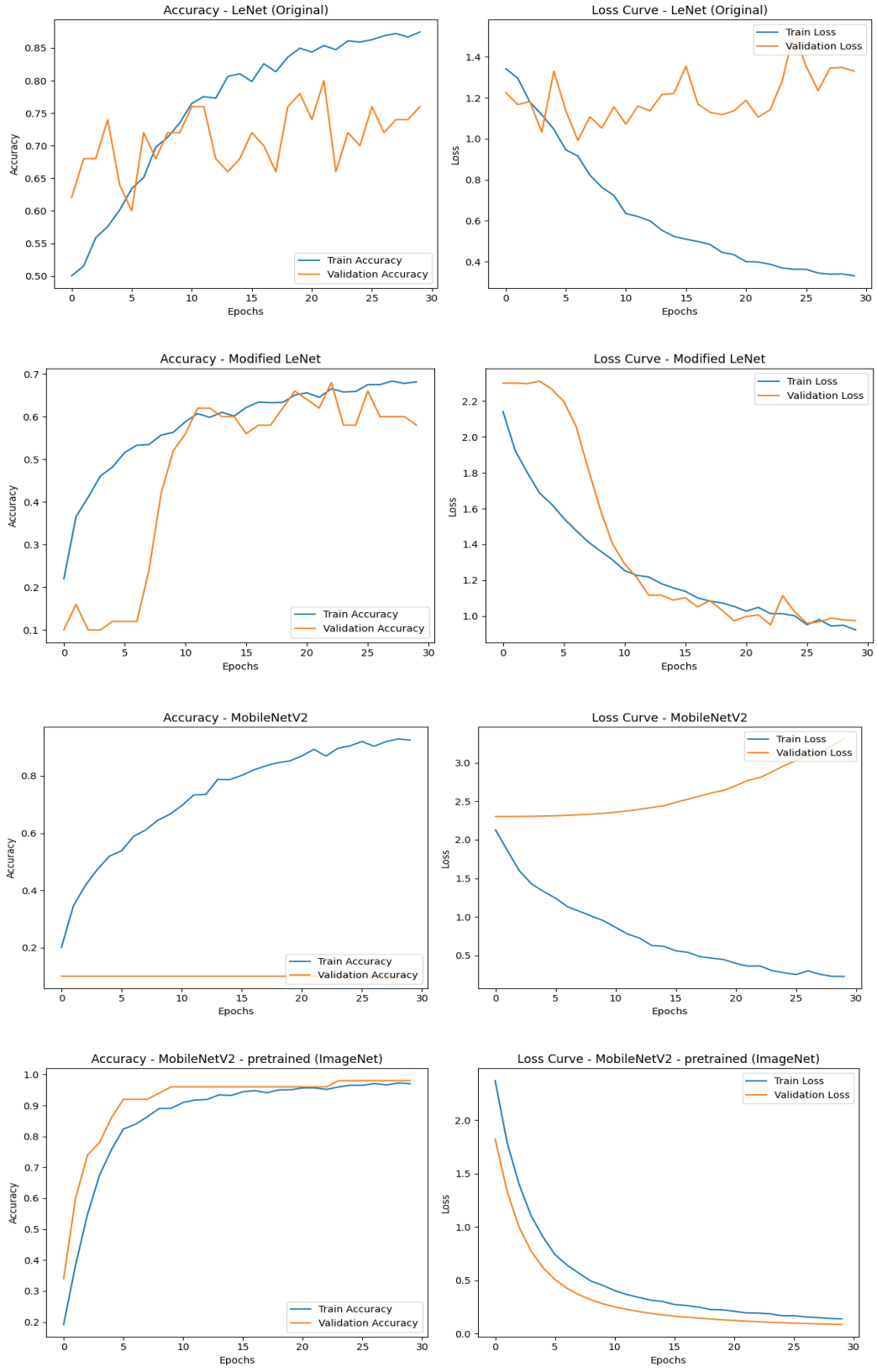

Figure 3. Accuracy and loss curves of all four models in our experiments.

4. DISCUSSION

The dataset we used is balanced, because for this dataset, the number of image data contained in each class is almost the same. For this project, we only used 10 of the original 100 classes. This was because the dataset was very large and contained many different types of images. Due to limited time and computing resources, we couldn't train and test all 100 classes within the limited timeframe. To ensure the smooth completion of the experiment and representative results, we randomly selected 10 classes from the total classes for model training, validation, and testing. This allowed for smooth project execution while reducing the amount of data and conserving computing resources.

5. CONCLUSION

While complex tasks typically require neural architectures with greater connectivity and depth, which typically increase training time and memory consumption, this study observed a significant shift. In this experiment, despite having a deeper structure than LeNet (which typically means slower training), MobileNet reduced training time by approximately half. This is attributed to MobileNet's efficient design, which integrates lightweight components, significantly improving training throughput while maintaining performance.

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JUDGE'S FEEDBACK:

It was a great pleasure to have Huanyin Ye as my student in the Computer Science Accredited Online Research Programme at Immerse Education. The course began with an introduction to research skills, and based on his research interests, a topic was suggested that focused on the importance of deep learning in modern classification models. Various examples of research skills were demonstrated using this topic. The skills covered in this course included familiarising students with the different types and nature of research, research planning, finding and using resources, analysing information, structuring research, and proper citation techniques.

His research interest was in machine learning and artificial intelligence. The project component of the course included both instructional materials and a research element. He learned the fundamentals of AI, including artificial neural networks, deep learning, and machine learning concepts. He successfully developed his own AI classifier and practically trained, compiled, and tested several deep learning-based models.

Huanyin had an advanced understanding of Python programming prior to starting the course. He also has a strong mathematical background, which he effectively applied throughout the project, particularly in complex AI topics such as neural networks and classification. The complexity of this project is typically at an undergraduate university level, yet he successfully achieved all objectives and wrote a well-structured research essay.

Throughout the project, Huanyin demonstrated outstanding interpersonal and organisational skills. He worked collaboratively with his tutor, managed his time effectively, and demonstrated strong analytical thinking to overcome challenges and complete each task successfully. Huanyin Ye is an intelligent and competent student with an exceptional ability to understand complex ideas quickly. I am confident that he will achieve great success in the future and become a valuable contributor to any academic or research institution he joins.

HUANYIN'S TIPS:

- My advice to future researchers is to stay curious, and not be afraid to ask questions. Start early, stay organised, and enjoy the process of learning rather than focusing only on the final result. Research is about growth as much as achievement.

Gurleen Kaur

GURLEEN'S BIO:

Gurleen is an alumna of the Business, Economics, and Entrepreneurship Online Research Programme. She wrote her research paper on a social entrepreneurship startup, reflecting her strong interest in social impact and addressing social issues. She aspires to pursue a career in politics and economics while continuing to contribute to society through academic writing and public speaking.

WeIntern – a scalable startup platform that aims to ensure access to meaningful, real-life work opportunities for high school students.

ABSTRACT

This research paper proposes and evaluates "WeIntern," a scalable startup platform that aims to ensure access to meaningful, real-life work opportunities for high school students. It deals with a structural market gap: the severe shortage of accessible internships for teens, which, in turn, restricts their early career exploration. This paper applies foundational concepts of business, economics and entrepreneurship to assess the startup's execution and success. It uses both primary and secondary data.

INTRODUCTION

High school plays a crucial role in shaping a student's future. Early exposure to real-world work environments is crucial for them to make the correct decisions for their future and build their resume.

Traditional internship ecosystems exclude high school students. Internshala, a platform with millions of users, primarily serves college and university students. Opportunities that do exist are often geographically limited, fiercely competitive, expensive, exploitative or secured through personal networks.

Therefore, the absence of a dedicated platform to connect high school students to meaningful, affordable, accessible local and online internship opportunities exists in the market. Moreover, no central portal exists for high schoolers to access internships they are eligible for. WeIntern is proposed as a solution to this, by leveraging existing opportunities and community networks.

MARKET ANALYSIS: STRUCTURAL BARRIERS TO EXISTING OPPORTUNITIES

Specialized programs (such as Ladder Internships and The Intern Group) which provide structured and meaningful internships pose significant financial barriers (often costing over $2500). Furthermore, although remote opportunities are available on online platforms these are scattered across the web and thus, users have to search for them actively instead of finding them in one single, easy-to-navigate marketplace.

In an interview, Arshdeep Kaur, an ambitious high school student stated that “Searching online for internships feels like hitting a wall. Everything is for college students. The few that are available are either generic or for very specific fields like HR or creative writing.”

This is evident on existing networking platforms like LinkedIn which prioritises older students. The few that high schoolers can apply to are clerical do not offer meaningful learning.
This was further solidified in an interview with 17 year-old Kanak Purewal, a high school student who completed an informal internship at a business firm last summer.“I was fetching tea and arranging papers the whole time. I didn’t actually learn anything related to Business.”

Furthermore, A national survey found that 77% of high school students expressed interest in volunteering to gain work experience, more than college students, who stood at about 63%1 Yet research indicates only 2% of high schoolers had internships before graduation.2 Though the numbers may have shifted slightly over the years, this mismatch between supply and demand is a clear market gap.

BUSINESS OVERVIEW

WeIntern is a double-access model. In the Guardian Swap system, guardians (often parents) of students offer internships in their profession in exchange for their own child securing an internship with another guardian on the platform. In case a guardian cannot participate, students may opt for paid internships on the platform.

The platform would mainly focus on local internships for interns to gain hands-on experience. However, the remote option would still be available. The model will gain credibility and attract students through certifications and optional mentor-endorsed recommendation letters.
Hosts will be assisted in the execution of a structural internship by our platform. By handling matching, foundation agreements and structure of the internships, the platform allows students and host to focus solely on mentorship and learning.

REVENUE MODEL AND FINANCIAL STABILITY

Tier 1: Guardian Swap (Free Access)
To access internships, the students have to contribute a verified internship opportunity that is hosted by a parent or guardian to the platform. Once the commitment has been verified and background checks have been conducted, the designated student is given full access to all available internships hosted by the other professionals on the platform. This results in a self-run supply with almost zero customer acquisition cost.

Tier 2: Paid Access
For students without a participating guardian, the platform will provide a paid internship placement service. This ensures equity for those with diverse family situations.

Moreover, this revenue is used to support platform operations like platform maintenance, host verification processes, customer support, and marketing to recruit hosts from small businesses and NGOs to supplement the guardian pool.

Premium Features:
Additional revenue streams through add-ons include mentor-endorsed letters of recommendation, and structured skill badges (e.g., research literacy, leadership, communication). Additionally, the platform can also consider forging partnerships with schools and NGOs to provide bulk subscription access for student bodies.

THE 4PS OF MARKETING ANALYSIS

Product: The core product is a well-defined, verified early-work experience which has been specifically developed for high school students. The platform's emphasis on certified, affordable and accessible local internships that provide realistic work experience differentiates it from existing market options. Remote internships will be available but remain a secondary product.

Price: The price will remain region-sensitive to balance affordability with sustainability of the startup and align with the existing charge for educational services in the region.

Place: While the platform will be digital and accessible nationwide, marketing and operations must be localized, especially during initial stages. The Guardian Swap model limits the user to a certain proximity.

Therefore, the venture will be launched in dense residential areas with a concentration of families and professional workers for strong local networks. Families in urban and suburban areas see value in early professional exposure.

Promotion:

- Partnerships: By teaming up with schools and career counsellor, we can reach out to the target families and high school students. Collaborations with local businesses and NGO's can offer essential internship opportunities for the platform.
- Content Marketing: Develop social media campaigns that promote career readiness, early work exposure and the platform itself, among student communities.
- Referral Program: Provide discounts or freebies to those users who refer new members successfully.
- Local PR: Media reports that put forward the summer internship success stories and students' accomplishments.

MINIMUM VIABLE PRODUCT (MVP) & FEASIBILITY:

In the initial stages, a MVP will be launched in a particular area/region, with manual matching and limited verification. Following the completion of the internships, feedback from hosts and students will help to refine logistics and operations before scaling. Early feasible targets should be set including but not limited to:

- Involving 500 students and 100 internship hosts within six months.
- Create and launch a web-based platform within 6 months for scaling.

RISK ANALYSIS & MITIGATION:

In an interview with a guardian (potential host), Mr. Devinder Singh, a significant risk arose, host hesitancy and quality of internships. He commented, “I’d be happy to mentor a curious student for a few hours a week. But I wouldn’t know what exactly to have them do here. How is it going to be different from having an employee.” His concerns highlighted major risks faced by the platform.

Risk 1: Low-quality internships are a significant threat to the platform’s reputation. A guardian that lacks experience in hosting internships may lower the quality of internships through insufficient, unfulfilling tasks or inadequate mentorship. Mitigation: Newcomer hosts that lack experience will be assisted in setting up internships and creating the curriculum for students. Mandatory feedback will be implemented at completion of an internship. Platform moderators can follow up on poor reviews and remove low-quality hosts.

Risk 2: A principal risk is that professionals in the industry may feel that hosting and mentorship are a significant time drain or a liability. Others may work in fields not easily adaptable to internships for teenagers. This could lead to a significant supply shortage. Mitigation: Actively recruit host organizations independently (small businesses, NGOs) alongside guardian-offered internships to meet the demand in the market at all times. For guardians, emphasize the low time commitment in internships and support them in initial set-up to reduce their workload.

Risk 3: Due to the involvement of minors, safety risks are vast and can lead to devastating reputational and legal consequences.
Mitigation: All hosts have to be subjected to a thorough check before an internship comes into operation. There will be standardized contracts which stipulate each party’s rights, expectations, and the code of conduct to be followed. Safety regulations will also be given to parents and students.

CONCLUSION:

WeIntern is an innovative startup that solves a well-documented gap in the internship ecosystem for high school students. The utilization of the guardian swap model results in attracting both supply and demand simultaneously, thus creating a self-replenishing marketplace.

The model thoughtfully applies concepts of Business, economics and entrepreneurship, particularly the 4Ps, revenue modeling, and MVP testing to leverage existing theories in the execution of a scalable startup. While risks related to quality and safety exist, they can be solved through the proposed mitigations and appropriate operational execution.

JUDGE'S FEEDBACK:

Gurleen was an exceptional student in the Business Management class this December, consistently demonstrating intellectual maturity, strong analytical abilities, and a clear interest in structured business thinking.

She engaged actively in class discussions and case studies, often contributing insights that reflected both empathy for real-world problems and an ability to evaluate them through a strategic and economic lens. Gurleen approached coursework with seriousness and independence, showing discipline in research and confidence in articulating her ideas.
Her research project, WeIntern, stood out for both its originality and depth of analysis. Gurleen identified a genuine and well-evidenced market gap, i.e. the lack of meaningful internship opportunities for high school students, and supported this with a strong combination of primary research (interviews) and secondary research (credible surveys, academic and policy sources).
Her research was not surface-level; it demonstrated careful analysis of quantitative data, clear interpretation of statistics, and thoughtful integration of qualitative insights to humanise the problem she identified.

Gurleen's ability to apply core business frameworks rigorously was particularly impressive. Her revenue model, Guardian Swap mechanism, 4Ps analysis, MVP strategy, and risk mitigation plan were all logically developed and grounded in real constraints, especially around safety, quality control, and equity. The level of detail in her risk analysis, especially concerning minors, host quality, and supply-demand balance, reflects advanced critical thinking and strong ethical awareness

While the project could be further strengthened by more explicit financial projections on how the startup will drive recurring revenue, the overall quality of research, clarity of structure, and realism of execution were excellent.

Overall, Gurleen demonstrated a level of research sophistication, strategic reasoning, and social awareness well beyond typical high school standards. She shows strong potential for future success in business, economics, and social entrepreneurship (which she indicated interest in pursuing in the future).

GURLEEN'S TIPS:

- Pay attention to the topics being covered in the classes and actively participate in the discussions. The knowledge you extract from these sessions and interactions will help you immensely in your research.
- Don't take citations lightly! Ensure that your sources are credible and readily accessible. Keep track of them during your research to avoid last-minute panic..
- Don't just read. Reflect on your sources and draw connections between different sources to form a comprehensive and well-rounded paper.

Ecrin Azra Aslan

ECRIN'S BIO:

Ecrin Azra Aslan is an International Baccalaureate Diploma Programme student at NUN Schools in Istanbul with a strong academic interest in chemistry, molecular science, and interdisciplinary scientific research.

She recently completed the Immerse Education Accredited Online Research Programme under the supervision of Jahanzaib Nowsherwan (DPhil Candidate, University of Oxford). Her research project, "Kinematics and Dynamics of a Horse and Rider Jumping," explored the biomechanical and physical principles behind horse-and-rider motion, focusing on kinematics, force distribution, and motion analysis.

Through this research, she developed skills in scientific literature review, analytical thinking, and academic writing. Her broader academic interests include molecular science, biochemistry, and the application of scientific research to real-world problems.

Kinematics and Dynamics of a Horse and Rider Jumping

ABSTRACT

Horse jumping is a complex motion involving coordinated interaction between kinematics and dynamics. During a jump, the horse converts part of its forward motion into vertical lift through powerful hind-limb extension. This investigation explores the physics behind horse jumping using fundamental mechanics concepts.

Two types of jumps are analyzed: a high vertical fence requiring maximum height and a wide water obstacle requiring maximum horizontal range. By applying simplified motion models, Newton's laws, and energy principles, the study explains how speed, force, and angle of take-off affect jump performance.

INTRODUCTION

Jumping is one of the most physically demanding skills in equestrian sports such as show jumping and eventing. From a physics perspective, a jump represents a transition from motion on the ground to projectile motion in the air. While on the ground, the horse accelerates forward due to muscular force, but once airborne, gravity becomes the dominant force acting on the system.

Understanding both kinematics (how motion occurs) and dynamics (why motion occurs) helps explain how horses successfully clear different types of obstacles. This project investigates two common cases:

- A high vertical fence, where the key requirement is vertical height.
- A wide water barrier, where the key requirement is horizontal distance.

By applying basic mechanics, the motion of the horse and rider is analyzed in a simplified yet realistic way.

PHASES OF A HORSE JUMP

A horse jump can be divided into four main phases:

Approach Phase:
The horse moves toward the obstacle with increasing speed while adjusting its stride length. The rider maintains balance, control, and direction.

Take-Off Phase:
The horse pushes against the ground using its hind legs. This generates a force that produces both upward and forward acceleration.

Flight Phase:
Once airborne, the horse and rider follow a curved path similar to a projectile moving under the influence of gravity.

Landing Phase:
The front legs touch the ground first and absorb the impact, followed by the hind legs. Proper landing reduces injury risk.

PART 1: JUMPING OVER A HIGH FENCE

In order to clear a high fence, the horse must reach a sufficient vertical height. This mainly depends on the vertical component of the take-off velocity.

As the horse leaves the ground, gravity acts downward and slows the upward motion until the vertical velocity becomes zero at the highest point of the jump. The relationship between vertical velocity, height, and gravity can be expressed as:

$h = v^2 / (2g)$

This shows that the higher the upward velocity at take-off, the greater the height the horse can reach.

From a dynamics perspective, this upward velocity is generated by the force applied during take-off. According to Newton's Second Law:

$F = ma$

This means that the greater the force applied by the hind legs, the greater the acceleration and therefore the higher the jump. Strong muscles, correct timing, and rider position all play a major role in clearing high fences safely.

ASSUMPTIONS AND SIMPLIFICATIONS

To keep the investigation at an appropriate IB level and avoid unnecessary complexity, the following assumptions are made:

- The horse and rider are treated as a single mass.
- After take-off, the motion is considered as projectile motion.
- Air resistance is ignored, as its effect is relatively small.
- The ground is assumed to be flat.
- The take-off and landing heights are assumed to be approximately equal.
- The horse leaves the ground with a certain initial speed and launch angle.

These simplifications allow the physics to be analyzed clearly without losing the main ideas.

PART 2: JUMPING OVER A WIDE WATER BARRIER

For wide obstacles, the main challenge is not height but horizontal distance. The horse must travel far enough forward to clear the water.

Physics shows that the horizontal distance of a projectile depends on three factors:

Initial speed
Launch angle
Gravitational acceleration

The horizontal range of a projectile can be described by the relationship:

$R = (v^2 \sin 2\theta) / g$

This shows that the range increases with speed and also depends strongly on the launch angle. The maximum range occurs when the launch angle is approximately 45 degrees. This explains why water jumps usually require more forward speed compared to vertical fences.

ENERGY CONSIDERATIONS

During take-off, the horse converts muscular energy into kinetic energy. As the horse rises during the jump, this kinetic energy is gradually transformed into gravitational potential energy, given by:

$PE = mgh$

For a horse with a mass of approximately 500 kg clearing a height of 1.6 m, the potential energy required is:

$PE \approx 500 \times 9.81 \times 1.6 \approx 8000\ J$

This shows that a very large amount of energy is needed for a single jump, explaining why jumping is physically demanding and requires proper conditioning.

IMPULSE AND MOMENTUM

The take-off phase is very short but involves extremely large forces. The concept of impulse helps explain how the horse's momentum changes during this brief time. Impulse is given by:

Impulse = Force × Time

If a force of 8000 N is applied for 0.3 s, the impulse becomes approximately 2400 Ns. Since momentum is given by:

$p = mv$

This impulse produces a vertical speed of about 4.8 m/s, which contributes directly to the height of the jump. This shows how force and time together determine jumping performance.

ROTATION, BALANCE, AND CONTROL

In real jumping, the horse does not behave as a simple particle. During flight, the horse rotates slightly and the rider shifts body position to maintain balance. This involves concepts such as torque, angular motion, and center of mass. These effects help ensure a safe landing and smooth continuation after the jump, showing that real motion is more complex than simple projectile models suggest.

CONCLUSION

This investigation shows that horse jumping is a powerful real-life application of classical mechanics. High fences require strong vertical acceleration and force, while wide water obstacles depend mainly on forward speed and an optimal launch angle. Kinematics helps explain how the horse moves, while dynamics explains why the motion occurs.

By understanding these principles, riders and trainers can improve performance, increase safety, and develop more efficient training techniques.

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- FEI – Show Jumping Rules and Course Design Guidelines.

JUDGE'S FEEDBACK:

Ecrin Azra Aslan's evaluation demonstrates a clear and confident understanding of her review paper, effectively highlighting the strengths of her central argument. She integrates key elements from the course—such as theoretical frameworks, critical reading strategies, and the principles of academic paper writing—to support her analysis in a detailed and cohesive manner. Her ability to connect course theory with her own evaluative insights shows strong engagement with both the material and the writing process.

ECRIN'S TIPS:

1. **Choose a topic you are genuinely curious about.** Research becomes much more engaging when you investigate something that personally interests you.

2. **Start with strong background reading.** Understanding existing research helps you build a clearer research question and structure your project effectively.

3. **Stay organised throughout the process.** Keeping structured notes and documenting your sources makes writing the final paper much easier.

4. **Be open to feedback from your supervisor.** Guidance from experienced researchers is extremely valuable for improving both your methodology and your academic writing.

5. **Enjoy the process of discovery.** Research is not only about results; it is also about developing critical thinking, curiosity, and problem-solving skills.

Getting Involved: Steps to Complete an Online Research Project

1

Submit Your Enrolment

Once you have submitted your enrolment and paid a deposit, you will be sent a booking confirmation asking for more information on your academic background and goals.

2

Be Matched With One Of Our Expert Tutors

Using your academic background form, our team will match your profile with one of our expert tutors from Oxford, Cambridge and Ivy League Universities.

3

Receive Your Course Induction Pack

Once we've found your tutor, confirmed your timetable and received your full fees, you will receive final instructions containing details about your programme, such as a course overview, how to access your virtual classroom, as well as any additional material from your tutor.

4

Start Your Course

Choose from a 10 – 20 hours programme with 1:1 tutorials each week. You will also be required to research and prepare your project in your own time.

5

Graduate

At the end of the course, your academic research project will be independently assessed and you will receive a certificate of completion, as well as a detailed evaluation from your tutor.

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