Select relevant research papers from reputable conferences and journals, such as CVPR, ICML, NeurIPS, and others (as discussed in the entire semester), with a focus on works published or accepted in 2023 and comprehensively address the following four questions, Your answers should reflect your understanding of the current advancements and trends in the field. Additionally, for each question, create a visual abstract using your preferred Generative AI models. These visual abstracts should effectively encapsulate the key concepts and insights derived from your detailed analysis of the selected papers.

20 marks for each question + 10 additional marks for visual abstract = total 120 marks.

Deadline: Dec 4, 2023

Q1. In the context of natural language processing, develop a deep learning solution that leverages the capabilities of a Large Language Model (LLM). The task is to create a system that can generate creative writing prompts based on a given theme or keyword. The system should be able to understand the context provided by the user and generate diverse and engaging prompts that encourage creative writing.

Outline the key steps you would take in designing this solution, including how you would train the LLM, the kind of data you would require, and any potential challenges you might face in ensuring the relevance and diversity of the prompts generated. Additionally, discuss how you would evaluate the effectiveness of your system.

Q2. As an AI researcher, you are tasked with developing a system that can automatically generate creative writing prompts for a wide range of genres, including science fiction, fantasy, mystery, and romance. The system needs to be capable of understanding the unique elements that define each genre and generate prompts that are not only genre-specific but also original and engaging.

Your challenge is to design a deep learning model that leverages the capabilities of Large Language Models (LLMs) to achieve this goal. The model should be able to:

- Analyze and understand the key characteristics of different literary genres.
- Generate creative writing prompts that are unique, engaging, and appropriately tailored to each genre.
- Ensure a high degree of originality in the prompts to avoid repetition or clichés.

A. What architecture would you choose for this deep learning model, and why?
B. How would you incorporate a Large Language Model into your solution, and what role would it play in prompt generation?
C. Describe the training process for your model, including the type of data you would use and how you would ensure the model learns the nuances of different genres.
D. How would you evaluate the effectiveness and creativity of the prompts generated by your model?
E. Discuss any potential challenges you might face in implementing this system and how you would address them.

Q3. As part of a cutting-edge research team, you are tasked with creating an advanced system capable of interpreting and describing complex scenes in photographs. The system should not only recognize objects and elements within an image but also understand their context, interactions, and the overall narrative of the scene. This project requires the integration of language and vision models to process and describe visual data in a meaningful and descriptive manner.

Your challenge is to design a deep learning model that effectively combines language and vision capabilities to achieve this goal. The model should be able to:

- Analyze and interpret visual data from photographs, recognizing objects, characters, and environmental details.
- Understand contextual relationships between different elements in an image.
- Generate accurate and detailed descriptions of the scenes, capturing not just the visual elements but also the implied narratives or actions.

A. What architecture would you choose for integrating language and vision models in this project, and why?
B. How would you ensure that the model accurately interprets the context and relationships between elements in an image?
C. Describe the training process for your model, including the type of datasets you would use and how you would address potential biases in the data.
D. How would you evaluate the model's performance in terms of accuracy, contextual understanding, and narrative description quality?
E. Discuss potential ethical considerations and challenges in implementing such a system, especially concerning privacy and data usage.

Q4. You are part of a team tasked with developing a sophisticated educational tool for children. This tool aims to teach language and visual recognition skills by interacting with children through a series of progressively challenging tasks. The system uses pictures and corresponding questions to engage the children, adapting to their learning pace and style. The core of this system is a Language-Vision Model, but to enhance its effectiveness, you plan to incorporate Active Learning and Curriculum Learning strategies.

Your challenge is to design a deep learning model that integrates Language-Vision capabilities with Active Learning and Curriculum Learning methodologies to:

- Present educational content (images and text) in a manner that adapts to the individual learning curve of each child.
- Utilize feedback from the children's responses to refine and personalize the learning material and its presentation.
- Implement a curriculum that starts with basic concepts and progressively introduces more complex ideas, aligned with the child's growing understanding.

I. How would you architect a Language-Vision Model for this educational tool to effectively process and understand both visual and textual inputs?
II. In what ways would you incorporate Active Learning principles to ensure the model dynamically adjusts to the child's responses and learning progress?

III. Describe how you would apply Curriculum Learning techniques in the context of this tool. How would the model determine the appropriate progression of difficulty and complexity in the content?
IV. What kind of dataset would you require to train this model, and how would you address the challenges of data collection and annotation in this context?
V. Discuss the metrics you would use to evaluate the effectiveness of the tool in enhancing learning outcomes, and how you would ensure the tool remains engaging and educational for a diverse range of learning abilities and styles.
VI. What guard-rails would you implement to ensure the safety and privacy of the children using this tool?