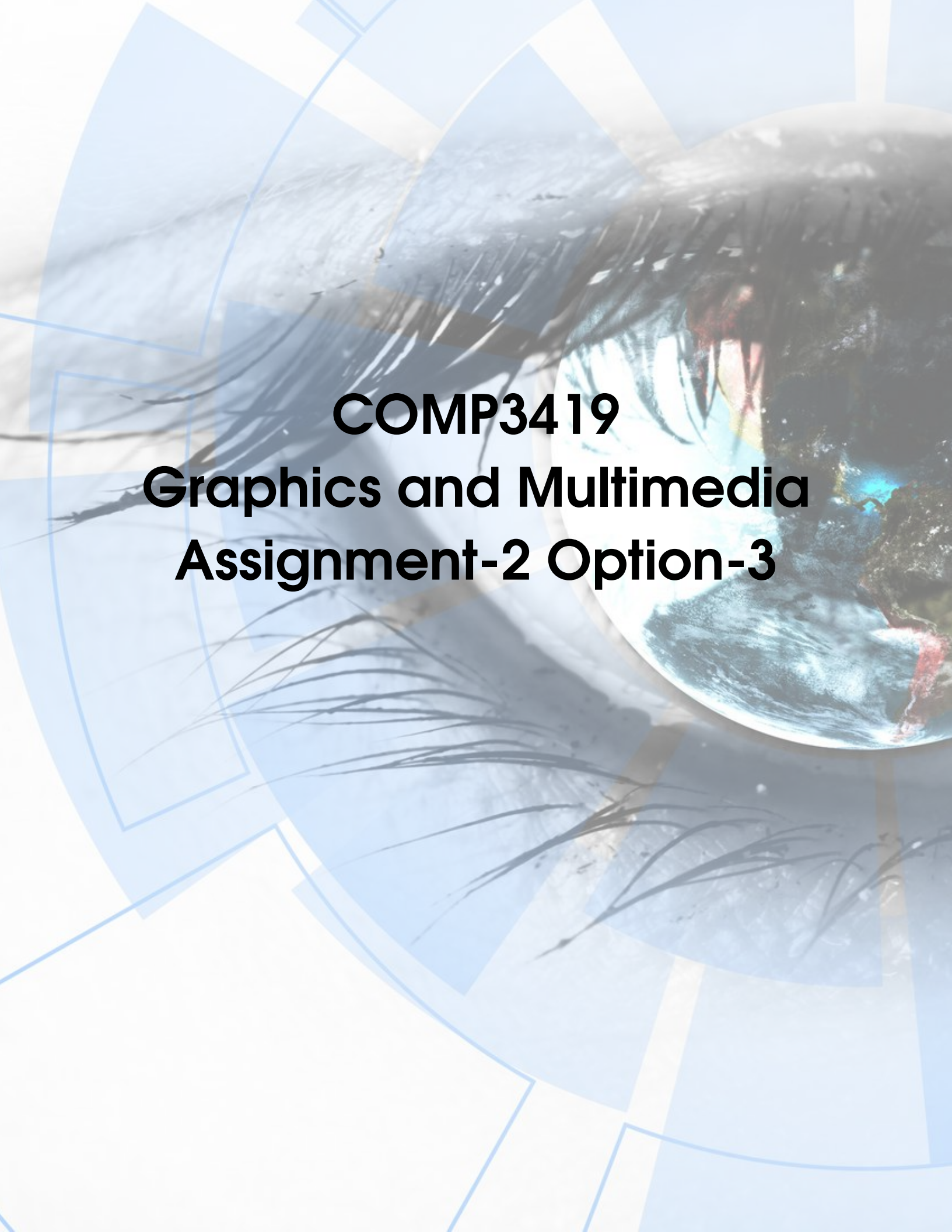

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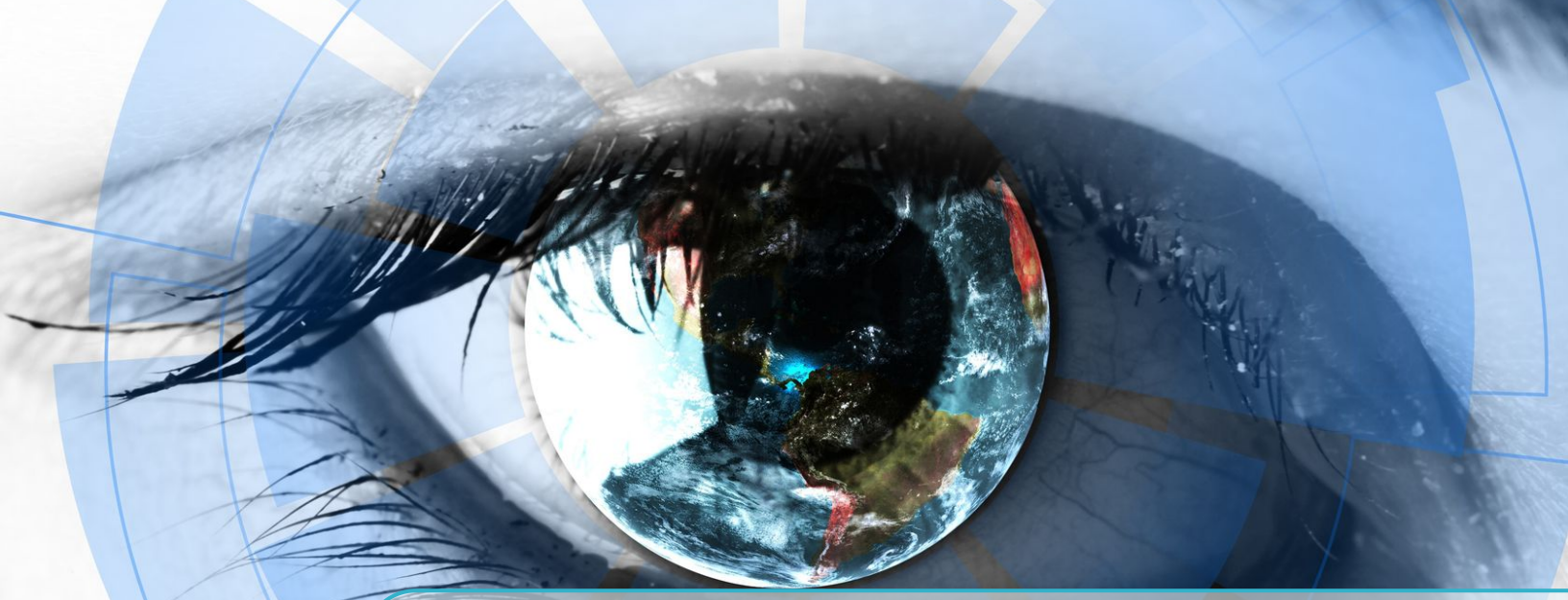

Option 3: German Traffic Sign Recognition

1 Key Information

- The mark of **"COMP3419 Assignment-2 Multimedia Project (Option-3: German Traffic Sign Recognition)"** will be given on canvas submission. Due time: 23:59 p.m., Sunday of Week 13 (6-Nov-2022).
- This individual assignment is worth **16%** of your final assessment.
- **GTSRB-Training** can be downloaded from here. **GTSRB-Testing** can be downloaded from here. An evaluation file (evaluation.py) is also provided for you to evaluate your method.
- **Submission Deliverable**: Students are asked to create a **zip** file of all deliverable, including a project report (written in LaTeX), all source code (with your best model saved), and a demo video. Please be aware of the following submission **restrictions** that (1) this zip file should be named as "SIDxxxxxxx_Asgmt2Opt3.zip" where xxxxxxx denotes the student ID (e.g., "SID450003419_Asgmt2Opt3"), and (2) the demo video should be named as "SIDxxxxxxx_Asgmt2Opt3.mp4" as well. Failing to follow these restrictions or missing of output video would cause a 5-mark penalty.
- A **README** txt file to describe the steps/instructions regarding how to get their source code running to derive the expected outputs. This file should help markers get familiar with the submission.
- Submission **will only be marked if** all deliverable can be **accessed** from the Canvas System, and they can be **runnable** following instructions provided in README txt file. Once plagiarism is detected by the Canvas system, the student will receive zero mark immediately, as well as other related penalties from university.

2 General Marking Policy

Late Submission Policy

For the late submission cases, penalties will be assigned according to the university wide late penalties for assignment Clause 7A of the Assessment Procedures.

Special Consideration and Arrangements

While you are studying, there may be circumstances or essential commitments that impact your academic performance. Our special consideration and special arrangements process is there to support you in these situations. More information on how to lodge the special consideration application, can be found from this webpage.

3 Introduction

Traffic sign recognition is a very important computer vision task for a number of real-world applications such as intelligent transportation surveillance and analysis. While deep neural networks have been demonstrated in recent years to provide the state-of-the-art performance traffic sign recognition, a key challenge for enabling the widespread deployment of deep neural networks for embedded traffic sign recognition is the high computational and memory requirements of such networks. The German Traffic Sign Benchmark is a multi-class, single-image classification challenge. Figure 1 shows some samples in the German Traffic Sign Recognition Benchmark (GTSRB).

Figure 1: Some examples in the German Traffic Sign Recognition Benchmark (GTSRB).

4 Dataset Description

- The dataset used in this assignment containing more than 50,000 images in total, where 39,209 images are in the training set while the rest 12,630 are used for testing. Each image contains

one traffic sign, with a total of 43 types of traffic signs. The image sizes varying from 15 × 15 to 250 × 250 pixels.

- Totally, 43 classes of signs are labeled and annotated for each image. The main objective is a multi-label classification task to classify the sign in one image.
- GTSRB-Training contains the following structure. There is one directory for each of the 43 classes (0000 - 00043). Each directory contains the corresponding training images in one class. The images are PPM images (RGB color). Files are numbered in two parts: XXXXX-YYYYY.ppm. The first part, XXXXX, represents the track number. All images of one class with identical track numbers originate from one single physical traffic sign. The second part, YYYYY, is a running number within the track. The temporal order of the images is preserved.
- GTSRB-Test contains the following structure. There is one directory that contains all test images (12,630 images). The images are PPM images (RGB color). Files are numbered in ascending order: 00000.ppm to 12629.ppm.
- GTSRB-Test-GT is a CSV file containing the annotation for GTSRB-Test. In the CSV file, it contains 8 kinds of annotations: Filename; Width; Height; Roi.X1; Roi.Y1; Roi.X2; Roi.Y2; ClassId. For example, 00000.ppm; 53; 54; 6; 5; 48; 49; 16 means Filename = 00000.ppm and ClassId = 16.

R Hint: To further improve the model performance, some keywords are provided for your own interest: attention network, transformer, generative adversarial network, transfer learning, domain adaptation.

5 Method Design (8%)

4% Students are requested to develop an learning-based automatic framework for this sign classification task. Its pipeline might include but not limited to data augmentation, machine learning, deep learning, or a combination of these various types of methods. You can use any open-source libraries, such as Pytorch, scikit-learn, Keras and Tensorflow.

3% Students are also requested to fine-tune their method, complete performance evaluations (following the evaluation.py given), and discuss the significance of their proposed approach.

1% Some ablation studies should be performed to verify the performance gain caused by each individual component proposed in your approach and/or other attempts made, such as data augmentation techniques adopted, data preprocessing steps implemented and etc.

R You can get some ideas about method design from the research papers uploaded on Canvas (Reference_Papers_Opt3.zip). These papers are well-selected to present a variety of method designs and levels of complexity.

6 Project Report (8%)

The report should contain introduction, methods, experimental setup, results & discussion, conclusion, and references. It should be 2 – 4 pages (maximum 6) in two-column layout, using this template (`http://www.latextemplates.com/template/wenneker-article`) to follow the scientific style and formatted with LaTeX[1]. A brief guideline of the report sections is as follows:

[1] Do not worry if you have not used latex before. It has a similar syntax to HTML. You can find a handy online latex editor at `https://www.overleaf.com/`.

1% Introduction: introducing the project aim, methods and findings (suggested in 200 - 300 words; no more than 500 words).
2% Methods: presenting the details of your method developed, including brief description of method theories and details in design choices.
1% Experimental setup: describing the dataset and evaluation metrics (suggested in 100 - 200 words; no more than 250 words).
2% Results & Discussion: presenting the evaluation results of each method, including evaluation of main design choices, and if applicable presenting results from combining various methods. Based on the experiment results, insightful discussion is expected to demonstrate the corresponding analysis performed. Tables and figures are preferred to be used for result demonstrations.
1% Conclusion: summarising the study and findings (suggested in 100 - 120 words; no more than 150 words).
1% References: listing literature and other references (papers and/or online resources).

7 Deliverable

Students are requested to create a zip file of all deliverable, including

- All the related source code (with your best model saved).
- A PDF project report formatted with LaTeX.
- A demo video to introduce your method and findings.
- See *Key Information* section for submission restrictions.

Demo Video: The presentation of your method designs, findings, as well as your final results, should be recorded as a video, using any recording tools available (e.g., Zoom), and the expected duration is 3-5 mins (no more than 5 mins). It is suggested to use Microsoft PowerPoint/Google Slides along with the experiment results to present your model performance, following the same structure of the project report.

Bonus Marks: Different bonus marks will be distributed based on the ranking of the evaluation metrics, over all submissions made to Canvas:

- top 10% - 4 marks
- top 50% - 2 marks
- top 85% - 1 mark

Please note that if any flaw or unfair comparisons found in the evaluation results, no bonus mark will be awarded and corresponding marks will be deducted.

8 Google Cloud Platform Education Grant for COMP3419 Students

You can either work locally or use the remote computing platform Google Cloud Engine (click here), which is funded by Google Cloud Platform Education Grant for COMP3419 students, to gain a better computational resources (CPU, GPU, TPU, etc).

Student Google Cloud Coupon Retrieval Access

- You will be asked to provide your name and school email address (e.g., **unikey@uni.sydney.edu.au**), which needs to match the domain (**please choose the default domain@uni.sydney.edu.au**). An email will be sent to you to confirm these details before a coupon is sent to you.

- You can only request **ONE** code per unique email address with university domain.
- Here is the URL you will need to access in order to request a Google Cloud Platform coupon, **click here**.
- Watch the Google Cloud Platform Essentials video series on YouTube.
- Instructions for how to redeem grants in Google Cloud Platform and click **"Redeem Now"** button.
- A **comprehensive tutorial** on Google Cloud setup and dependencies setup for deep learning based AI projects can be found from **here**.
- Pleases **ensure your instances closed** everytime when you finish with using or training in Google Cloud, to avoid unexpected waste in your coupon.