Australian National University

COMP4660 –Report Writing

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ANU Academic Skills

What are the task requirements?

Your task is to:

1. devise a classification or regression **problem** to investigate **using the data set provided** – this can be reproducing, extending or modifying the problem which is described in the paper related to that dataset;

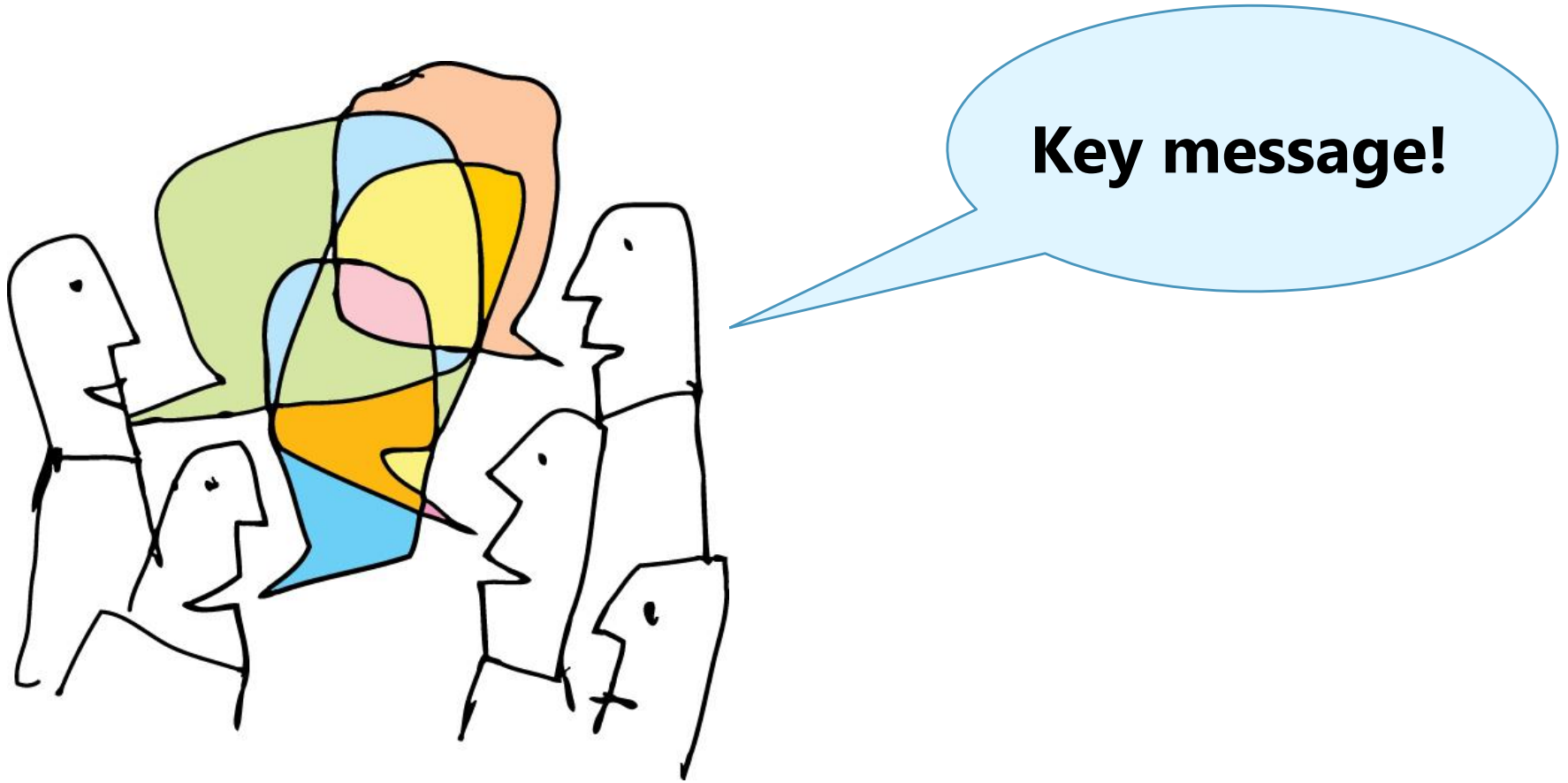
2. implement a **neural network in PyTorch / Python** to solve the problem and implement a method to determine the performance of the neural network;

3. implement **a technique from the literature** (paper selected as described above) and determine **its benefit** or **lack of benefit**;

4. **compare your results with results published in a research paper** reporting results on the data set you chose (see below); and

5. write a **report** on your work

What is the most important thing you need to include in a report?



Activity: Key messages

Evaluate each of the samples. For each, identify the problems. What needs to be done to improve the key message?

- Sample 1:
- ***Automatic Image Annotation (AI) is rife with problems. It is important that programmers develop approaches to deal with these issues.***

Activity: Key messages

- Sample 2:
- ***Automated Image Annotation is good at identifying and labelling concrete things, but is less good at labelling the concepts or ideas conjured up by the images. The problem is these are what users look and search for, hence it is important to create AIA that better reads and predicts these elements.***

Activity: Key messages

- Sample 3:

It is difficult for Automatic Image Annotation to predict the types of abstract keywords that are desirable to online users. This report describes the development and testing of a system that interprets an image's visual attributes and proposes high-level/abstract words commonly associated with those attributes, drawing from a pool of 50 popular conceptual keywords.

A key message

- Establishes the **purpose** of your report
- Establishes what you "**do**" in your report (i.e. describe, review, test, analyse)
- Conveys not only **what** happened, but **why**?
- **Structures** your report: you write to **persuade** your reader of the key message

What will be your key message?

- Discuss in pairs

Report structure

- Reports are not continuous pieces of writing like essays, but are divided into multiple sections
- Each section has a purpose that ties it to the overall message
- Each paragraph has a point that ties it to the purpose of the section

Core sections of a report: IMRD

Introduction	Why you did this task (assert KM)
	↓
Method	How you completed it
	↓
Results	What you found
	↓
Discussion	Why it is meaningful (further support for KM)

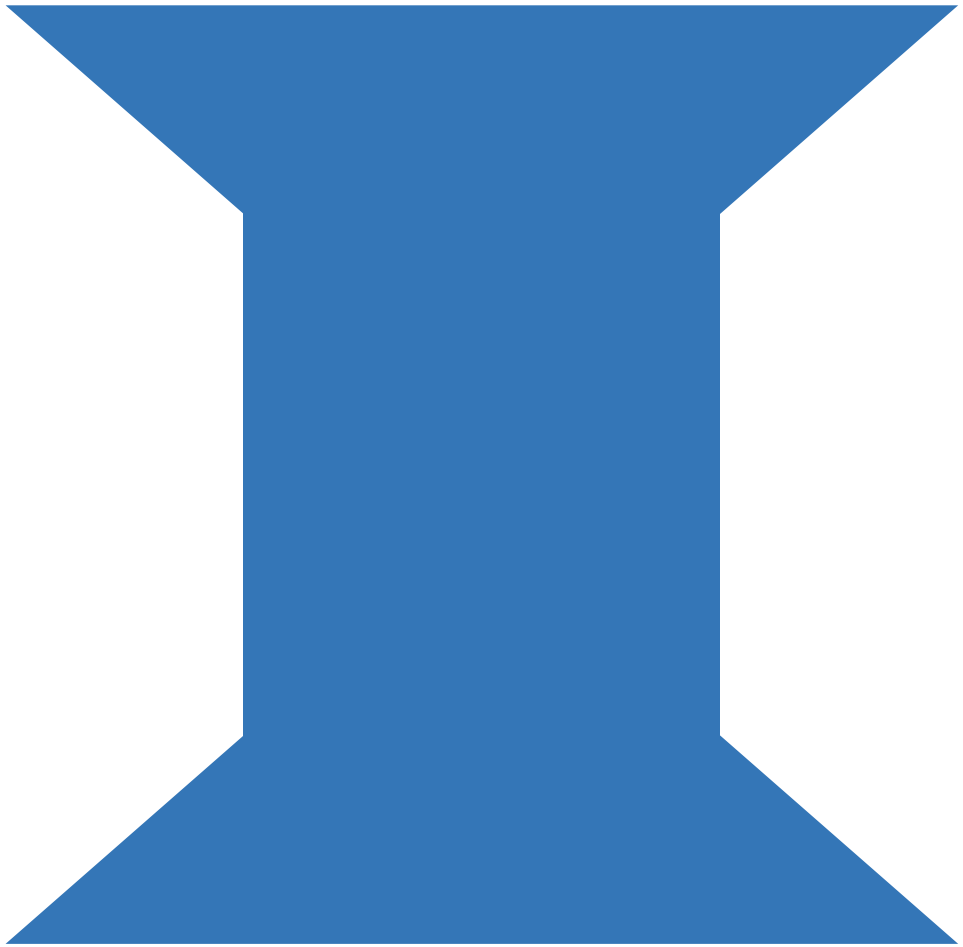
Core sections of a report: IMRD

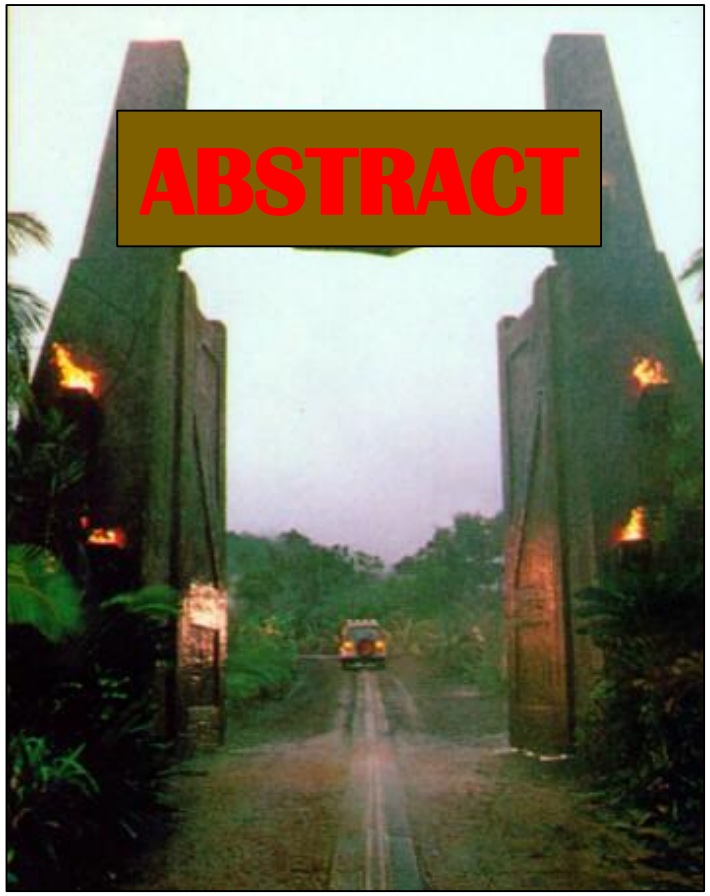
Introduction

Method

Results

Discussion





From: https://jurassicpark.fandom.com/wiki/Park_Gate

- The Abstract (or Introduction if no abstract is required) is the reader's gateway into your report
- Provide a concise and accurate snapshot of your report

Abstracts

Are these four questions answered in the abstract?

- **Why** you did this task
- **How** you completed it
- **What** you found
- **Why** it is meaningful

The problem

The emergence of social media sharing communities has led to the need for accurate context-based image retrieval methods, which can be accomplished by an automatic annotation system. The ability to annotate high-level context-based words is necessary for such a system; however, it is not well researched due to the inherent difficulty caused by the semantic gap. This paper identifies a set of high-level words that are frequently used by users to describe images, with a baseline system constructed using linear classifiers. The concept of 'generalised attributes' is then proposed and used to improve prediction by bridging the gap between image features and high-level words. The generalised attribute 'anchor feature' proposed, together with the 'total distance' feature selection method, leads to optimal performance. The resulting system yields not only an improvement in statistical accuracy over the baseline, but also a huge improvement in the quality and relevance of images retrieved in image retrieval and tags predicted in tag recommendation.

Method

Key message

Significance

(Adapted from Zhang 2016, p. 151)

Peer writing – Sample 1

As the base for breast cancer analysis, cell information such as cell size, shape and texture features has been widely used. Traditional machine learning methods are often used to analyze the cell information and classify the cell type. In this paper, two new neural network models will be presented for this classification task. One is the combination of artificial neural network(ANN) and shared weights autoencoder, and the other one contains both ANN and genetic algorithm(GA)-based feature selection. In these models, the ANN is used for classification. Shared weights autoencoder and GA-based feature selection are used to solve the redundant features problem. Furthermore, I conduct several experiments with the Breast Cancer Wisconsin(Diagnostic) dataset that has well collected data. My experiments investigate the impact of autoencoder, the effectiveness of shared weights technique and the impact of GA-based feature selection. I also analyze the performance of my two models and logistic regression model. My results confirm the feature extraction ability of autoencoder and the effectiveness of shared weights technique. What is more, the results show the superior performance of my two models compared with logistic regression model. And GA-based feature selection performs better than shared weights autoencoder but cost more computation resources.

Peer writing—Sample 2

When we solve a variety of problems using Convolutional Neural Networks (CNNs), we usually need to choose a moderate size of each layer in the net. Especially when there are complicated problems with large data, an appropriate size of network helps us reduce the running time and improve the efficiency of training process. In this situation, pruning techniques are essential as it can remove the excess units which perform no real function in the final output of the neural network. In this paper, I made a study of these hidden units and performed an easy but powerful pruning technique to remove one kind of them in CNNs with different size. After pruning, the network has a similar good performance as before. However, it performs worse when comparing to other modern pruning techniques these days.

Activity: Introductions

- Revisit the introduction of the article provided

- Can you see these key ingredients?
  - Background or context
  - Rationale for investigation
  - A hypothesis, aim, or research question

- Where does each ingredient begin and end?

Background

As photo-sharing web communities like Flickr and Instagram become increasingly popular, the number of images and their associated tags increases at an incredible rate. Flickr alone has 1.6 million images uploaded per day. However, the imprecision and noisiness in user labelling makes accurate context-based image retrieval and management difficult. Given the large numbers of images, expert manual labelling is infeasible. Automatic tagging or automatic image annotation (AIA) (Brahmi and Ziou 2004), which predicts the list of tags associated with images, has become an important research topic. 'Tag ranking' (Liu et al. 2009), which ranks the tags according to their relevance, is also becoming an active research focus. The combination of the two techniques yields a ranked list of tags relevant to images, effectively facilitating image retrieval and image management.

Rationale

Out of the large research efforts devoted to AIA, little research has considered the prediction of abstract keywords, which are hard to detect directly from low-level visual features due to the 'semantic gap' (Smeulders et al. 2000). However high level words are often more desirable to users; therefore, the ability to predict these words plays an important role in achieving practical and accurate context-based image retrieval. This work targets such high-level words and proposes methods to accomplish their detection and prediction.

Aim

This work facilitates the following:

- Efficient and accurate image retrieval. As the ranked list of words we predict are sets of high-level words that are often used to describe images by users, this leads to retrieval results that are closer to users' real needs.
- Automatic analysis of the images and recommend tags for images. This would assist the uploading of images, which is a usual behaviour in daily lives.
- Increased ease of photo management; supports easy browsing and organising of images based on their visual contexts.

(Zhang 2016, pp. 151-152)

Methods

- Show how you completed the task, tools used
- Provide **enough detail** for the work to be reproducible and falsifiable

Results

- Show what you found
- Aligned with hypothesis/aim
- Also quite descriptive
- Your main findings/results are highlighted
- Use graphs, tables and diagrams where applicable

Presenting results

- Can readers follow your data (e.g. tables, figures) without specialist knowledge?
- Do you need to explain or change formats?
- Are you only presenting results that are necessary for your story?
- What are your pet hates?

Sample figures

- How do the samples present data?
- What do body paragraphs and legends present?
- How are legends structured?
- How much detail is provided?
- Is there enough information for you to understand what the data shows, i.e. the methods and results?

Discussion

- Explain why your results are significant, including:
  - Do your results answer your question or confirm/reject your hypothesis?
  - How do your results compare to other studies/theory?
  - Were there interesting/surprising results?
  - What were the limitations of the study?
  - Are there directions for future study?

Referring to figures, tables in text

- How does the sample discuss the figures and tables in the paragraphs?
- What information is given in the legends and headers?
- What does it emphasise?
- How does it support the key message?

Topic sentence states the ***point*** - the idea and the argument

Supporting sentences provide evidence and analysis to support the point

Concluding sentence summarises the idea and/or links to the next

A paragraph addresses one main idea in approximately

Activity: Paragraphing

Topic sentence; **linking words**; **references**

Classification methods transform the image annotation problem into an image classification problem by treating images as data samples and tags as class labels. Each word might have several dictionary senses that are visually distinct, which is known as the 'visual polysemous' property. **Therefore**, image annotation can be transformed into a multi-class classification task, which can be solved using support vector machines (SVMs) or multi-label learning algorithms **(Lu et al. 2009)** and multi-instance learning algorithms **(Zhou and Zhang 2006)**. The co-occurrence probability between regional image features and concepts can be estimated to produce annotations for images. This can be achieved using either the machine translation-based model or cross-media relevance model. The machine translation model **(Duygulu et al. 2002)** views the annotation keywords and features as two different languages that describe the same image, and translates between those two languages. **On the other hand**, the cross-media relevance model **(Jeon et al. 2003)** uses blobs to represent the semantic contents of images, where blobs are formed using discretised feature clusters. Graph models **(Tong et al. 2006)** treat every image and every keyword as a graph node, and the relations between them as edges; label information can then be propagated from labelled images to unlabelled images.

(Zhang 2016, p. 153)

Topic sentences

- Provides the key theme for each paragraph
- A useful test:
  - If you give someone only the topic sentences from a report, they should be able to figure out the main key message of the whole report.

Conclusion

- Remind the reader of your key message and key parts of that message
- What are the implications of your findings?
- Can be quite short

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