Formative submissions

Overview

- General comments
- People who didn't submit, or had only just started
 - Advice for getting going and building to a good mark
- People who submitted well-developed work
 - Advice for getting right up into the very top marks
- General comments (again)
- Examples
- Unit feedback

- The submissions were really good...
- ...Almost everything I've looked at in detail so far was at 2:1/1st level...
- ...Or on the way there, if the work continued at the same standard

- Reviewing them in detail takes a long time...
 - (Written feedback; highlighted mark scheme; indicative mark)
- ...Currently I have:
 - Randomly sampled them, looking for good practice (relatively fast)
 - Started reviewing them and writing individual feedback, in order (slow)
- ...Once I've gone through them all, in full, I'll review again at the end for consistency...

- I hope to be able to release them next week...
- ...But will prioritise doing a good job...
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- In labs today and tomorrow
- I can't give you your written feedback, highlighted criteria, indicative mark
- (Even if you see your assignment today)
- Until I've marked them all
- We'll just use the time for working on the assignment
- And of course you're welcome to ask questions as normal

- I've tried to summarise the key points I've seen across the submissions...
- ...Hopefully these slides are the most useful bit
- (The examples are a random sample of good practice from people who gave permission)

People getting started

There is no "wrong" way to do it – and I've seen lots of variation in the submissions, almost all of them really good

A good report will consist of the following three sections:

- 1. [~1,500 words] A "Longlisting" section: identifying a range of relevant algorithms, building blocks and techniques from AI briefly explaining them, and their potential links to image classification problems;
- 2. [~2,000 words] An "Analysis" section: critically analysing the suitability of (combinations of) options set out in (1) for adoption by the company, based on:
 - a. the contextual information surrounding this specific image classification problem (see Appendix A);²
 - b. the theoretical characteristics of the various options set out in (1) and/or your own experimental investigations into the options set out in (1) based on a suitable dataset/(s);
- 3. [~500 words] A "Recommendation" section: drawing on (2) to present a conclusion that argues for a single overall approach to the problem that you believe the company should pursue, and giving your reasons why. No single solution is perfect and this will involve acknowledging weaknesses as well as highlighting strengths.

The extra "guidance" template on Moodle can help – but it's fine if you don't want to use it ("following the suggestions is not mandatory and you're free to address the assessment criteria as you see fit")

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Longlisting

k-Nearest Neighbours

Naïve Bayes

Decision Trees

(Ensembles)

Supervised Learning

Logistic Regression

(Support Vector Machines)

Artificial Neural Networks

This was the basis for many good longlisting sections, and it would be a good place to start if you're feeling behind

(Just assuming raw pixel values are processed as features – as we know Founder 1 is already doing)

The basic job is: "name/explain/link (to image classification problems)"

Some people included lots of detail in the explanations (probably to "fill up" the word count) – but there's no *need* to

A short explanation is absolutely fine

The marking criteria is encouraging you to consider a good *range* of things (it's not actually asking for really detailed explanations)

So if you're still getting started, don't worry about word count

Longlisting (2:1 criteria)

This is the only word that changes between the different class bands

II(I) (60-69%)

(Generally:) Suitably presented and referenced throughout, including any necessary appendices, and commensurate with the overall word count (see also Sections 2&3):

- (1. "longlisting" section:) identifies a wide range of relevant algorithms, building blocks and techniques, giving explanations and potential links to image classification problems for each;
- (2. "analysis" section:) critical analysis of identified options (in 1) based on a thorough study of the context surrounding the problem (see Appendix A), and a precise corresponding analysis of the theoretical characteristics of those options and/or by presenting precise corresponding experimental investigations of your own;
- (3. "recommendation" section:) a reasoned conclusion is set out, which draws on earlier analysis (in 2) to argue fluently for the adoption of a specific approach to the problem by the company, highlighting most relevant weaknesses and strengths.

Why does the "longlisting" section exist?

- The longlisting section isn't there to catch you out, or trip you up...
- ...It's there to help you quickly think through all the things that *might* possibly be useful...
- ...Hopefully your later sections then end up much stronger than if you
 just jumped straight into writing them...

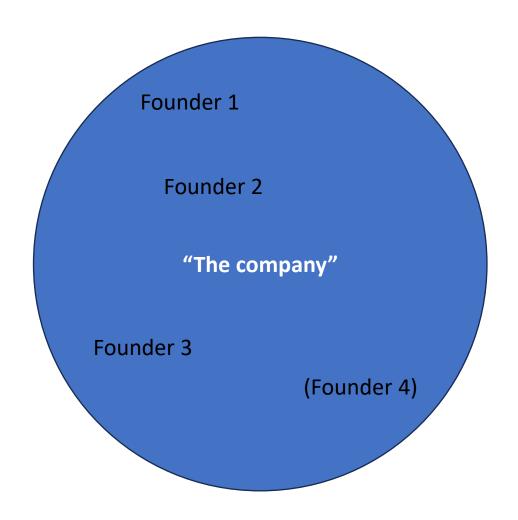
- (...As the "guidance" template says: "this section should be a chance to build up marks quickly"...
- ...More on other things you might add later on...)

Let's not worry about (a) and (b) yet, let's just think about this basic problem: which of the options might be suitable?

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What is needed?



Thinking about the four "Founders" and what they want was the basis for many good analysis sections

They encapsulate the problem and also what other stakeholder groups might want too (e.g., sellers, buyers, moderators, investors)

Here were the "big" things most people identified:

<u>Founder 1</u>: efficient (lots of users); simple (implement in-house) or good open-source options

<u>Founder 2</u>: accuracy not critical (only good top-10?)

<u>Founder 3</u>: minimise compute requirements on the back-end (push to user devices?)

(<u>Founder 4</u>: consistent user experience, regardless of object/appearance (balanced classes?))

The options

k-Nearest Neighbours

Naïve Bayes

Decision Trees

(Ensembles)

Supervised Learning

Logistic Regression

(Support Vector Machines)

Artificial Neural Networks

For each one of these options, it's possible to give some positives and negatives without any specific context

You can look up all/most of them in Lantz and find a whole table of them (or easily do a little bit of research)

Even better: you don't have to list lots of positives/negatives without context

You can focus on the things that will matter to the company

So don't try to list loads for each option if you're just getting started; only those that are relevant to the company

(If aiming high, the idea is to expand section 1, and give at least some analysis of everything you include – more later)

Analysis

- The basic unit is: "option [from section 1]/property/link to context"
- E.g., "k-NN is simple enough that it could be implemented in-house (Founder 1)"
- E.g., "k-NN can generate very complex generalisations so could support good top10 accuracy in principle (Founder 2)"
- E.g., "k-NN prediction times grow with the number of training examples meaning it could increase back-end computation (Founder 3)"
- E.g., "k-NN training stores all the training examples meaning it could be too large to run on users' devices (Founder 3)"

You will naturally cover these two things, if you work in this way – they are what we've just talked through

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And note that for most people, this bit just gets ignored (and it doesn't in any way limit your mark)

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Analysis (2:1 criteria)

These are the only words that change between the different class bands...

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...So we want to try and say at least something about each requirement, and at least something about each option

- By the time you've drafted that Analysis section, you are unlikely to have a clear "winning" solution...
- ...None of the options is perfect...
- ...And there are likely to be 2 or more that are viable...

- This is the section where you make your "judgement calls"
- Which of all the viable options are you going to go for?
- And what are your reasons?

- There will be some brief repetition from the previous section
- But you are also trying to weigh the different pros and cons (across different options)
- And explain how you're reaching a decision

- Mention the weaknesses/requirements you're not able to (fully) meet, as well as the strengths/requirements you can meet
- None of the options will be perfect, but which do you think is best overall

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You can make your case strongly...

But don't omit weaknesses (there is credit for identifying them)...

Easy to get into the 50-60% band

- Following over these slides for each section, it's easy to get yourself up to a 2:2
 - Essentially requires being "clear" and "congruent" (consistent, making sense)
- The next step would be to try and add *some* (not all) of the extra steps we look at in the later slides
- To get yourself into the 60-70% band

(2:2 criteria)

A range of components; linking to the context based on properties that make sense; making an understandable argument with at least one strength and one weakness

II(II) (50-59%)

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- (2. "analysis" section:) critical analysis of identified options (in 1) based on a **clear** study of the context surrounding the problem (see **Appendix A**), and a **congruent** corresponding analysis of the theoretical characteristics of those options and/or by presenting **congruent** corresponding experimental investigations of your own;
- (3. "recommendation" section:) a reasoned conclusion is set out, which draws on earlier analysis (in 2) to argue **clearly** for the adoption of a specific approach to the problem by the company, highlighting **some** relevant weaknesses **and** strengths.

Indicative language: Clear, confident, consistent, thoughtful, accurate, careful, congruent, coherent

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People aiming high

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First class criteria

The words that have changed all relate to being as thorough as possible

I	(Generally:) Suitably presented and referenced throughout, including any necessary appendices,
(70-100%)	and commensurate with the overall word count (see also Sections 2&3):
	(1. "longlisting" section:) identifies a comprehensive range of relevant algorithms, building
	blocks and techniques, giving explanations and potential links to image classification
	problems for each;
	(2. "analysis" section:) critical analysis of identified options (in 1) based on a meticulous
	study of the context surrounding the problem (see Appendix A), and a sophisticated
	corresponding analysis of the theoretical characteristics of those options and/or by
	presenting sophisticated corresponding experimental investigations of your own;
	(3. "recommendation" section:) a fully reasoned conclusion is set out, which draws on earlier
	analysis (in 2) to argue convincingly for t he adoption of a specific approach to the
	problem by the company, highlighting all relevant weaknesses and strengths.
1	

(The other bold words should come naturally if you aim for this)

First class criteria

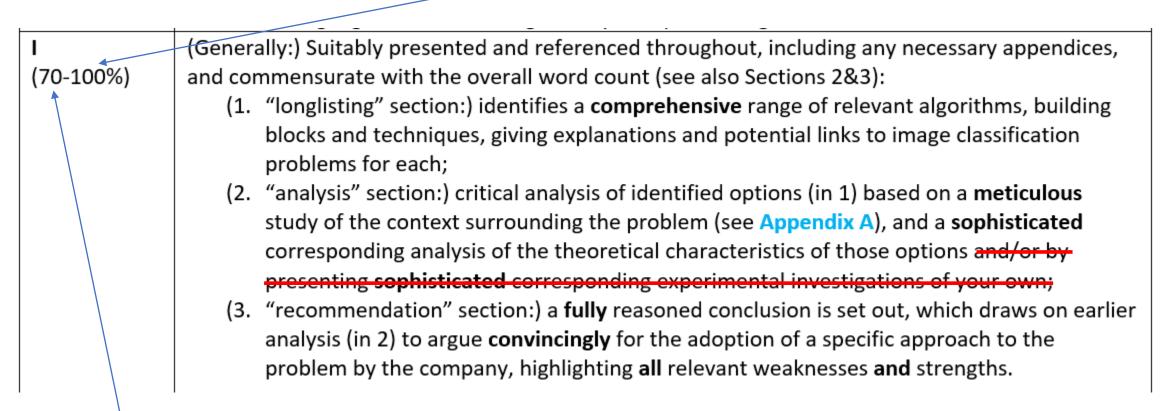
If you're aiming for 100% then you're aiming to cover the relevant things we've met on the unit and all the requirements (with some margin for error)...

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	analysis (in 2) to argue convincingly for the adoption of a specific approach to the problem by the company, highlighting all relevant weaknesses and strengths.

...And at least *something* from your own research (aim for at least one thing)

First class criteria

If you're aiming for 100% then you're aiming to cover the relevant things we've met on the unit and all the requirements (with some margin for error)...



...But you can definitely still get into the 70%+ band without covering everything

Longlisting

k-Nearest Neighbours

Naïve Bayes

Decision Trees

Ensembles

Supervised Learning

Logistic Regression

Support Vector Machines

Artificial Neural Networks

Recipe steps surrounding the creation of one of these supervised learning models: e.g., data collection options, other datasets, cleaning steps, "safe" hyperparameter tuning approaches (like holdout), performance measures

Extra optional hyperparameters that can help with training them: e.g., alternative measures/distributions, voting/sampling strategies, gradient descent options, regularisation strategies, deep learning guidance

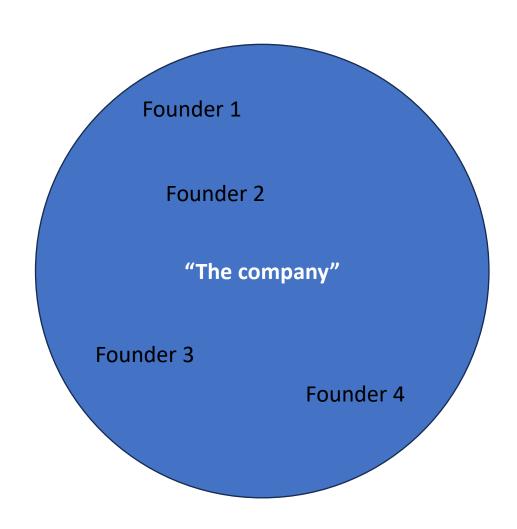
<u>Feature extraction techniques specifically for images (and better than just using raw pixels)</u>: e.g., local gradient/edges, handcrafted features, bags of visual words, pre-trained CNN filters

More advanced models, designed specifically for images: e.g., CNNs, ViTs, incl. transfer learning with existing models

Making use of unlabelled data/addressing class imbalances: e.g., crowdsourcing, unsupervised learning for ?, semi-supervised learning, unsupervised pretraining, (often the weakest)

<u>Other</u>: dimensionality reduction, feature engineering, software, hardware, matrix multiplication, ...

What is needed?



(Still covering the requirements we set out earlier...)

Most of the interesting <u>extra</u> thinking was around:

<u>Founder 4</u>: consistent user experience, regardless of object/appearance (balanced classes?); desire to aim for a fair/accountable/sustainable/transparent system (FAST principles)

The moderators: how they are involved (past/future), how this relates to the above

<u>Some interesting/creative ideas around</u>: sellers, buyers, the venture capital firm, the laaS supplier, UK government (regulation)

"Rule of thumb" for a 1st

- It's really hard to give a general guide to getting "at least 70%"
- Generally it's not a good idea to aim to do the minimum
- Best to aim higher and leave yourself a margin for error
- Take inspiration from the previous couple of slides, and aim high

• Remembering that covering all of it, well, likely maps to 100%!

- The earlier sections work in exactly the same way
- It's generally necessary to be careful with your words if you're aiming high

- Skip introductory paragraphs saying what you're about to do?
- Avoiding really long explanations (perhaps left over from early drafts)
- Grouping similar components; e.g., see the "guidance" template for examples
 - "e.g., a short list of optimisers for gradient descent, or activation functions for use in artificial neurons, or handcrafted features for use with images, or methods for clustering in unsupervised learning, or image datasets to use in training, or deep networks for use in transfer learning, or models to use in regression/classification, etc., etc."

- Skip introductory paragraphs saying what you're about to do?
- Some being strategic about the points you make
 - E.g., not loads of negatives (for something that probably isn't going to feature in later sections)
 - E.g., making sure coverage is reasonable for the main contenders
 - E.g., grouping things together if they share a property (organise by requirements?)
 - E.g., picking out strong/weak options within larger related groupings

- Skip introductory paragraphs saying what you're about to do?
- Exactly the same guidance as in the earlier slides
- But you will hopefully have quite a few components to recommend
- And requirements to map them to

Smaller things

- How many references do I need?
 - There is no expected number
 - In principle, you should reference every time you use someone else's work or ideas
 - It's absolutely fine if you're mostly mentioning Lantz/Geron/Raschka
 - (The slides try to stick within the ideas presented in the readings at the end so feel free to reference them/whichever is easiest)
 - The cite it right scheme helps you to reference pretty much any source (incl. ChatGPT, lecture slides, etc.)
 - Don't get paralysed by having to reference some knowledge/inference is expected

Smaller things

- You can shift word count between sections
 - E.g., if you think you need less in the longlisting but more in the analysis, or vice versa
 - Or if you can make your recommendation more quickly

Smaller things

- Ambitious new ideas still need to be explained clearly...
- ...Or referenced if they come from somewhere else
 - Good to be ambitious, but it needs to hold together and make sense

- The submissions were really good...
- ...Almost everything I've looked at in detail so far was at 2:1/1st level...
- ...Or on the way there, if the work continued at the same standard

- Reviewing them in detail takes a long time...
 - (Written feedback; highlighted mark scheme; indicative mark)
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- I hope to be able to release them next week...
- ...But will prioritise doing a good job...
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- In labs today and tomorrow
- I can't give you your written feedback, highlighted criteria, indicative mark
- (Even if you see your assignment today)
- Until I've marked them all
- We'll just use the time for working on the assignment
- And of course you're welcome to ask questions as normal

Examples

- Thanks to people who agreed to share their work I asked because I thought they contained helpful examples of good practice
 - (I'm not able to show all of them don't take that as good/bad!)
- Please don't take photos, we have the lecture capture
- And obviously don't copy things
- We'll generally try and leave their recommendation sections
- I'll wait a little while to release the lecture capture If anything concerns you then drop me a message before the lab

Examples

• (Feel free to ask questions/make comments, but we shouldn't put anyone under too much scrutiny)

Unit Feedback

- About 20% or 1 in 5 responded thank you for taking the time!*
- There were positives, but let's concentrate on things to improve
- Slides should become readings/notes, available before lectures
- Lectures (ideally 2*1-hour slots) more visual, less material, more time
 - Spent on longer/better foundational explanations
 - Spent on taking questions
 - Spent on challenges/activities/interactions (e.g., quizzes)
 - With louder mic volume
- Set questions in both labs / coding element to assignment
- Assignment + template out early

Unit Feedback

- Final encouragement to go for it on the assignment
- Even if you didn't enjoy the unit there's still no reason not to aim for a first
- The standard of the formative submissions was really high, and you can definitely do it (even if you haven't started yet)
- Drop me a line if I can help you get started

Questions?