

COMP80131: Scientific Methods I

Coursework

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1 Overview

The assignment is composed of five different tasks. You are asked to report the result of each task in a single PDF document (to be submitted via Blackboard). The structure of the document has to follow the structure used in this document, by using the same name of sections and presenting them in the same order. For more details about the format, see Section 4.

The assignment has to be submitted by **12:59pm of 18 December 2015**.

2 Assessment

The total marks available for the coursework are 40, distributed on 5 different tasks (presented in Section 3):

- **2** marks are awarded for Task 1
- **4** marks are awarded for Task 2
- **6** marks are awarded for Task 3
- **20** marks are awarded for Task 4
- **8** marks are awarded for Task 5

The assignment will be graded according to the following four equally weighted factors:

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Completeness The assignment is almost entirely designed in steps. You should be able to fully complete all the tasks.

Correctness The assignment introduces some questions and challenges which have a precise answer. We expect you to provide those answers.

Critical analysis The assignment introduces some questions and challenges which do not have precise answers. We expect you to provide a sensible analysis and discussion.

Presentation and clarity of thought We expect graphs to be labelled and commented opportunely in the report. We don't expect typos or unreadable paragraphs.

3 Tasks

We will now present the tasks (next page).

**Task 1: Make yourself visible to the scientific community
(2 points)**

1. Create your Google Scholar account.
2. Explicitly mention your affiliation with the “School of Computer Science” at “The University of Manchester”. Your webpage is at `http://www.cs.man.ac.uk/~CSusername/` (did you know that you can manage your web space in the folder `~/public_html` of any workstation in the school?).
3. Set up an alert for new articles AND citations of at least three famous researchers in your field.

Notes

The task explicitly asks you to use Google Scholar. The School encourages the use of such service in order to make your publications accessible through the School website¹. If for some reasons you do not like the service, you are free to delete your account once your coursework is fully completed and submitted.

¹<http://www.cs.manchester.ac.uk/our-research/publications/>

Task 2: Let's skim some papers!
(4 points)

For each researcher you are following, select his/her most cited publication and answer the following questions:

1. Where and when have the articles been published?

Pick one random paper among the three previously selected.

1. Note down the title of the paper, current date and time.
2. Now skim it.
3. Note down date and time (hopefully the date didn't change :D).
4. Write what they did. (no more than 2 sentences)
5. Write two sentences about why you think the paper is good.
6. Write one sentence about where you think the paper is improvable.
7. Write how long it took to skim it, and how long the paper is (n. of pages, single or double-column?).
8. Write whether you would be interested in reading it for depth.
9. Which one of these activities would you confidently do? Write your answer.
 - (a) have a chat about it with one of your friends
 - (b) present it to your colleagues
 - (c) present it to your supervisor[s]
10. Write how long it would take to reach the confidence to present it to your supervisor[s].
11. Repeat the previous process (from 1 to 10) with one of the remaining two papers.

Write whether you changed anything in your way of skimming the paper and what exactly.

Task 3: Let's study a paper!
(6 points)

Select one of the first papers that one of your selected researchers published (perhaps when he/she was a PhD student like you). Pick a paper no longer than 5 pages and get some highlighters (at room 2.127 in the Kilburn Building).

1. Note down the title of the paper, current date and time.
2. Now study it (refer to the slide #13 of the Lecture 4 to find out the questions you are interested in).
3. Write what and how they did it. (no more than 4 sentences)
4. Write two sentences about why the paper is good.
5. Write one sentence about where the paper is improvable.
6. Write how long it took to study it, and how long the paper is (n. of pages, single or double-column?).
7. Check the reference list and write its length and whether you can identify authoritative names (e.g. authors cited in multiple references).
8. Which one of these activities would you now confidently do? Write your answer.
 - (a) have a chat about it with one of your friends
 - (b) present it to your colleagues
 - (c) present it to your supervisor[s]
9. Write how long would it take to reach the confidence to present it to your supervisor[s].

In no more than 5 bullet points, summarise what you have learned so far about your field that you didn't know before.

Task 4: Let's design an experiment! (20 points)

The aim of this assignment is to demonstrate your understanding of how to design an experimental protocol for a given scenario (presented later). Although you will need some understanding of the task, this assignment is NOT about SOLVING that task, rather on designing an experiment to evaluate it.

Provide the following as part of your answer:

1. A very brief description of the task. What is the question that you want to address/evaluate? (3 marks)
2. Rationale for the experiment: reason and motivation? What do you want to achieve? What question will you like the experiment to answer? What is the hypothesis? What do you expect to happen? (3 marks)
3. Measures and observations: what will you measure and observe in the experiment? Why? How will you measure those? Are these good evaluation metrics? (3 marks)
4. Data description: where and how will you get data for the experiment? Is there a benchmark? What will be a baseline? (3 marks)
5. Repeatability: will your experiment be repeatable by others? How will you ensure that? Will you make the data available? (2 marks)
6. Analysis of outcomes: how will you analyse the results? How will different outcomes help you reject or accept your original hypothesis? How will you make sure the outcomes are just not due to chance what kind of statistical significance test(s) you would perform? (3 marks)

The remaining 3 marks will be given for formatting style, clarity of thought and pertinence of the references. **The assignment for this task should be no longer than 2 pages.**

Notes

- Please design only a single experiment and consider only one question as part of the rationale for the experiment. Do not try to answer several questions through the experiment.

- Do not describe what *could* be done, but what you *will* do as part of the experiment.
- Be as specific as possible - “we will use several PCs or will recruit a large number of users” is not enough. Specify how many exactly.

Possible scenarios (select one)

- 1. Order of results in search engines** It is believed that users of search engines often do not read all of the results and tend to go with the first one that seems reasonable. A search engine wants to improve ranking of their results by using the information on which links users click on and has implemented a new strategy. Your task is to evaluate the new system. What (single) question will you like to address in the evaluation?
- 2. E-commerce security protocol** E-commerce needs a secure protocol to exchange multimedia for e-payment. In the current settings, one needs to trust the provider that they would deliver the e-goods once they receive the payment. You have created a new protocol that relies on a trusted third party that gets involved in case of disputes. How will you evaluate the protocol? What (single) question will you like to address in the evaluation?
- 3. Classification of entities on the Web** You have been asked to improve the way the names of educational institutions are recognised and highlighted on a Web page. You have come up with a new machine-learning method that uses 10 features. How will you evaluate the model? What (single) question will you like to address in the evaluation?
- 4. Your own scenario** Talk to Goran first.

Task 5: Let's practice some hypothesis testing (8 points)

Tom, a PhD student from the School of Computer Science at The University of Manchester, has been planning an experiment. It aims at studying different software systems with the purpose of evaluating them with respect to the classification performance (measured with $F_{\beta=1}$ score²) in the context of a Named Entity Recognition (NER) task.

Fifty (50) different datasets have been used to test every system. Tom already cleaned the data and made it available for download³ in different formats.

Unfortunately, Tom did not attend the COMP80131 (Scientific Method I) course last year, so you are asked to help him in carrying out a small hypothesis testing task.

Tom wants to know whether the mean performance is NOT the same in ALL the four systems. You are asked to:

- select an appropriate hypothesis test to support the investigation and present the results.
- produce a meaningful graphical representation of the data so that Tom may visually select the best among the four systems.
- perform a full pairwise significance analysis on every pair of systems' measurements.
- finally, suggest the best system among the four, knowing that *System A* is very quick, *System B* is not-well maintained, *System C* is moderately quick and *System D* is convoluted and slow.

4 Format

Your coursework will be submitted as a PDF document through the online BlackBoard platform⁴. Just one PDF file is expected.

4.1 General Tips

- Make sure all mathematical notation is correct and consistent.

²It provides ratio-scaled data. More at https://en.wikipedia.org/wiki/F1_score

³http://www.cs.man.ac.uk/~filannim/public/COMP80131/task5_data.zip

⁴<https://online.manchester.ac.uk/webapps/login/>

- Use a spell-checker. Use a spell-checker. Use a spell-checker. Please, use a spell-checker.
- Number your figures, and use *informative* captions. Ensure all graphs have meaningful axis labels/units. If you wish to have the reader compare two graphs, ensure their axes have *the same scale*: this is a **very** common mistake, easy to make, but easy to avoid.
- Reference the scientific literature appropriately and consistently [1]. If you use L^AT_EX, there is `bibtex`, an associated package that will organise your references for you. If you are using Microsoft Word, you can use EndNote⁵.
- Make sure that your assignment looks professional, clear and readable. What do we mean? Please, try to use L^AT_EX. ;)

5 How to immediately FAIL this module: Plagiarism

The University of Manchester has a zero-tolerance approach to plagiarism. Submitted work is systematically and automatically checked for plagiarism. **If you cheat or commit plagiarism you will be caught.**

6 Strict submission deadline

This coursework is due by **12:59 pm of 18 December 2015** and must be uploaded via BlackBoard.

References

- [1] <http://subjects.library.manchester.ac.uk/referencing>

⁵<http://endnote.com/>