Final Report

Exploratory Deep Learning Models: Determining Optimal Cutting Parameters for a Microtome 710082147

3rd Year Individual Project

I certify that all material in this thesis that is not my own work has been identified and that no material has been included for which a degree has previously been conferred on me.

Signed.....Jiaqi Yao.....

College of Engineering, Mathematics, and Physical Sciences
University of Exeter

Final Report

ECM3175/ECM3149

Title: Exploratory Deep Learning Models: Determining Optimal Cutting Parameters for a Microtome

Date of submission: May 3th

Student Name: Jiaqi Yao
Programme: Mechanical Engineering
Student number:710082147
Candidate number: 116251

Supervisor: Dong Wang

Abstract

This study investigates optimizing biopsy parameters through deep learning, utilizing the InceptionV3 model via transfer learning for assessing the quality of biomedical tissue sections. Experiments with various cutting angles identified optimal parameters that significantly improved tissue section quality. Additionally, image preprocessing studies showed that using original image data often resulted in better outcomes than using processed images. The research suggests further expanding classification methods, enhancing performance, investigating additional influencing factors, and dynamically adjusting slicing parameters. These proposals aim at developing fully automated histology instruments. The findings confirm the model's adaptability to various tissue types, highlighting its potential as a versatile tool in histopathology.

Keywords: Deep Learning Tissue Sectioning Transfer Learning InceptionV3

Table of contents

1. Introduction and background

Describe the background to the project.

This should introduce the topic; provide clear explanation of the aim, objectives and structure of the project. It should briefly identify plan of action for the project and identify any major assumptions or technical protocol or specifications adopted for the remainder of the project. It should also briefly introduce the format of the chapters and identify where the conclusions and recommendations are located.

1.1. Example first subheading

Some text in subheading/delete

Sub-heading levels can be added by adding a sub-heading and tabbing.

Table of contents should be updated if sub-headings are added/removed.

1.2. Example second subheading

Some text in subheading/delete

Sub-heading levels can be added by adding a sub-heading and tabbing.

Table of contents should be updated if sub-headings are added/removed.

2. Literature review

Describe what has been done in your specific topic by other people.

What has been done before?

How it shapes your project?

This must include precise information about the literature that was used to provide background information and to prepare the term of reference for the project. Concepts, conclusions and opinions taken from literature should be identified if they are later used in discussion or conclusions. All materials/ideas from other resources should be acknowledged by references.

2.1. Example first subheading

Some text in subheading/delete

Sub-heading levels can be added by adding a sub-heading and tabbing.

Table of contents should be updated if sub-headings are added/removed.

2.2. Example second subheading

Some text in subheading/delete

Sub-heading levels can be added by adding a sub-heading and tabbing.

Table of contents should be updated if sub-headings are added/removed.

3. Methodology and theory

Description of the methods/techniques used including the building blocks for the research; all the methods for evaluating results and outcomes; and clear background for results (including math formulae)

This should briefly detail the activities and the plan adopted for the successful completion of the project aim and objectives. It should conclude problems encountered that affected the project original programme and identify how these problems have been overcome.

3.1. Example first subheading

Some text in subheading/delete

Sub-heading levels can be added by adding a sub-heading and tabbing.

Table of contents should be updated if sub-headings are added/removed.

3.2. Example second subheading

Some text in subheading/delete

Sub-heading levels can be added by adding a sub-heading and tabbing.

Table of contents should be updated if sub-headings are added/removed.

4. Experimental work/analytical investigation/ design

Describe the design evolution of your project from conceptual, qualitative, quantitative, etc. analysis, experiments or design (hardware, software, procedure), design (of equipment or procedure).

4.1. Example first subheading

Some text in subheading/delete

Sub-heading levels can be added by adding a sub-heading and tabbing.

Table of contents should be updated if sub-headings are added/removed.

4.2. Example second subheading

Some text in subheading/delete

Sub-heading levels can be added by adding a sub-heading and tabbing.

Table of contents should be updated if sub-headings are added/removed.

5. Presentation of experimental or analytical results/descriptions of final constructed product

A clear presentation of experimental and/or theoretical results obtained, highlighting any trends or points of interest. Provide a detailed, logical analysis of your results, and critically analyse your data. Discuss your findings in details.

5.1. Example first subheading

Some text in subheading/delete

Sub-heading levels can be added by adding a sub-heading and tabbing.

Table of contents should be updated if sub-headings are added/removed.

5.2. Example second subheading

Some text in subheading/delete

Sub-heading levels can be added by adding a sub-heading and tabbing.

Table of contents should be updated if sub-headings are added/removed.

6. Discussion and conclusions

This section outlines a brief explanation of the significance and implications of the work reported, the general conclusions, and the recommendations for further work. It should summarise the conclusive points taken clearly and concisely from the previous chapters and from the results chapter or discussion sections of the previous chapters however structured.

- Description of what has been learnt from experimental/analytic at work or design
- Distillation of important findings and their significance
- Specific observations to inform future research

This is not the place to introduce new literature, discussion or conclusions points that have not been introduced, experimented, explored or validated in the previous chapters.

6.1. Example first subheading

Some text in subheading/delete

Sub-heading levels can be added by adding a sub-heading and tabbing.

Table of contents should be updated if sub-headings are added/removed.

7. Project management, consideration of sustainability and health and safety

Project plan as Gantt chart with tasks and milestones

Procedures and systems for project management

Researching, studying, and understanding the sustainability aspect of your project should be an important and vital part of your research. You should be able to demonstrate the process of identifying and mitigating environmental risk, the socio-economical impact of the project, demonstrating life-cycle analysis, recycling, carbon footprint, etc. It is expected that you undertake a professional approach when working on your project.

Provide details of the risk assessment (project related and health and safety) for your project. This should include a risk assessment and discuss the steps you took to mitigate risks.

Health and safety risk management is an important and vital part of each engineering project. You should be able to demonstrate the process of identifying hazards, estimating and prioritising risks, mitigating risks, and reviewing risks in the light of the progress of the project. It is expected that you undertake a professional approach when working on your project and that you follow the Health and Safety Guidelines of the College of Engineering, Mathematics, and Physical Sciences:

https://student-harrison.emps.ex.ac.uk/index.php?nav=69

7.1. Example first subheading

Some text in subheading/delete

Sub-heading levels can be added by adding a sub-heading and tabbing.

Table of contents should be updated if sub-headings are added/removed.

7.2. Example second subheading

Some text in subheading/delete

Sub-heading levels can be added by adding a sub-heading and tabbing.

Table of contents should be updated if sub-headings are added/removed.

References

All materials/ideas from other resources should be acknowledged by references. The author-date system (Harvard Citation System) or the numerical system is preferable. Only one system should be applied in the report.

[1] Insert references here – some example formats can be seen below
[2] Buckley, PJ and Chapman, M (1996) "Theory and Method in International Business Research", International Business Review, 5(3), 233-245.
[3] Oduoza, C.F. (1997) "Mass transfer in flow cells" Proc 5th IChemE Research Event, London, Institution of Chemical Engineers, 317-329.
[4] Baker, J., The 68000 Microprocessor, http://www.ex.ac.uk/~Jbaker/68000.html, last accessed 25/08/2004.
[5] …