University of Central Lancashire UCLan	**UCLan Coursework Assessment Brief**	2022-2023
Department of Computer Science	Module Title: Artificial Intelligence	
	Module Code: CO3519	Level 6
	Diagnosing skin cancer	This assessment is worth 50% of the overall module mark

THE BRIEF / INSTRUCTIONS

Summary

You need to implement and test a computer aided detection (CADe) tool to detect melanoma (skin cancer) in dermoscopy images (images of the skin). You should produce a report detailing the development and testing of the model.

Skin cancers, such as melanoma, can spread to other organs if not treated early. As with other cancers, early and accurate detection can support dermatological clinic work, potentially aided by artificial intelligence. Automated melanoma diagnosis tools could improve dermatologists' diagnostic accuracy by providing a second opinion. You will develop a computer-aided detection (CADe) tool to help clinical dermatologists detect melanoma in dermoscopy images (images of skin).

You will be using the International Skin Imaging Collaboration (ISIC) archive that contains the largest publicly available collection of quality-controlled dermoscopic images of skin lesions with the ground truth.

Algorithms and Techniques

Your approach should involve applying the concept of advanced AI (e.g., ConvNets). This course assessment gives you the opportunity to apply what you have learned in class to create a CADe tool for melanoma identification. Such CADe tool for melanoma identification can be designed using the following advanced AI techniques:
• DenseNet-161 • Inception v3. • NASNetALarge • Autoencoder • MobileNet-v2 • Medical Vision transformers (MVIT)

It is important to note that you are not limited to using only the techniques mentioned above. You can implement new advanced AI models or variants of existing models for the given problem. The latter can be more challenging but sometimes results in a publishable piece.

The Following Components Must Be Considered For Model Development And Validation

- You have a **class imbalance problem** in this dataset.
- Validation set is very small : Data Augmentation may be necessary.
- Choosing the right parameters for feature extraction or fine-tuning.
- Metrics to take into account to evaluate if the model is good.

Preparation of the data, training and cross-validation techniques, evaluation of the test sets and model comparisons are all crucial to the success of this type of practical development.

Each student will present and demonstrate their 'practical development' during classes in the week 11/12.

Your demonstration must include the following:

- What method or algorithm are you proposing/using?
- If you are using any existing implementations, how will you use them and justify the reason of using it to solve the given problem? How you have planed to improve or modify such implementations?
- How will you evaluate your results? Qualitatively, what kind of results do you expect (e.g. plots or figures)? Quantitatively, what kind of analysis will you use to evaluate and/or compare your results (e.g. what performance metrics or statistical tests)?
- Discuss the result obtained from your model . Explain why they worked and what alternatives can be taken in the future to solve the given problem.

PREPARATION FOR THE ASSESSMENT

To inspire ideas, you might look at recent deep learning publications from top-tier conferences, as well as other resources below.

- CVPR: IEEE Conference on Computer Vision and Pattern Recognition
- ICCV: International Conference on Computer Vision
- ECCV: European Conference on Computer Vision
- NeuralPS: Neural Information Processing Systems
- ICLR: International Conference on Learning Representations
- ICML: International Conference on Machine Learning
- Awesome Deep Vision
- Kaggle challenges: An online machine learning competition website. For example, a Yelp classification challenge.

This type of project would involve understanding the state-of-the-art image analysis models, and building new models or improving existing models for a vision task. The list below presents some papers on recent advances of ConvNets in the computer vision community.

- **Image Classification**: [Krizhevsky et al.], [Russakovsky et al.], [Szegedy et al.], [Simonyan et al.], [He et al.], [Huang et al.], [Hu et al.] [Zoph et al.]
- **Visualization and optimization**: [Szegedy et al.], [Nguyen et al.], [Zeiler and Fergus], [Goodfellow et al.], [Schaul et al.]

RELEASE DATES AND HAND IN DEADLINE

Assessment release date: 16th January 2023
Assessment deadline date and time: **17th April, 24:00 hours BST**

Please note that this is the final time you can submit – not the time to submit!
Your feedback / feed forward and mark for this assessment will be provided within 15 working days.

If you feel you need to apply for an extension/have mitigating circumstances you need to follow the correct university process detailed at https://www.uclan.ac.uk/students/support/extensions.php. Short-term extensions can only be approved if the application is made before the day of the deadline. If you have difficulties with this, please contact your Year Tutor.

SUBMISSION DETAILS

__Final Report__

The report should be 4-6 pages (excluding references). Your report should have the following structure:

- **Title, Author(s):** Only one person from your team should submit. Make sure all team members' names are included in this section.
- **Introduction (10%):** Describe the problem you are working on, and an overview of your results.
- **Background Reading(10%):** Discuss published work that relates to this project. How is your approach similar or different from others?
- **Data (10%):** Describe the data you are working with for your project. What type of data is it? Where did it come from? How much data are you working with? Did you have to do any preprocessing, filtering, or other special treatment to use this data in your project? If you are collecting new data, how will you do it and incorporate into your model?
- **Model Development (30%):** Discuss your approach for solving the given problems. Why is your approach the right thing to do? Did you consider alternative approaches? You should demonstrate that you have applied ideas and skills built up during the semester to tackling the given problem. It may be helpful to include figures, diagrams, or tables to describe your method.
- **Model Evaluation (30%):** Discuss the experiments that you performed to demonstrate that your approach solves the problem. You might compare with previously published methods, perform an ablation study to determine the impact of various components of your system, experiment with different hyperparameters or architectural choices, use visualization techniques to gain insight into how your

model works, discuss common failure modes of your model, etc. You should include graphs, tables, or other figures to illustrate your experimental results.

- **Conclusion (10%) :** Summarize your key results - what have you learned? Suggest ideas for future extensions or new applications of your ideas.
- **Supplementary Material:** Not counted toward your 4-6 page limit. Your supplementary material must include:
  - Source code of your project
  - Any relevant supporting materials E.g. Link to Cool videos of your work, interactive visualizations, demos, etc.

Please submit your Final Report as a PDF on Blackboard using the link "Assessment 2 submission" by the deadline. Upload your **Supplementary Material** in a Cloud Source Repository and **include the URL in your final report**.

The practical development must be **individual work**. This cannot be completed as a group. **Students must write and submit their own individual final report.** You can discuss solutions with other students, and ask for help from your lecturer if needed.

Honor Code

You should clearly cite your sources if you would like to incorporate ideas and code from papers, books, online references, or publicly available implementations into your strategy or algorithm. It is prohibited, however, to look at or integrate another group's code.

LEARNING OUTCOMES ASSESSED BY THIS WORK

- Apply the theoretical underpinnings of algorithms and techniques specific to artificial intelligence.
- Critically evaluate the principles and algorithms of artificial intelligence.
- Evaluate the theoretical foundations of artificial intelligence.
- Understand some of theoretical underpinnings of computing and apply them to given scenarios.

MARKING CRITERIA

Grade band	Marks available	A description of work example
3rd class	42	The report lists all tasks undertaken. There may be a few inaccuracies but most will be c[...] Writing may be brief, or poorly presented. Some items might be in bullet points rather t[...] full sentences.
	45	As above, but nearly all descriptions will be correct, though perhaps only explained brie[...]
	48	As above, but all descriptions will be correct.
2:2	52	The report lists all tasks undertaken, using the correct technical terms to explain the techniques used and why. At least most of the tasks will be correctly explained, althoug[...] some parts may be incomplete.
	55	As above, but nearly all descriptions will be explained using technical details.
	58	As above, but all descriptions will be explained using correct technical details.
2:1	62	The report lists all tasks undertaken, explaining in detail the technique used and why. At[...] most of the tasks will have a detailed and clear explanation, demonstrating understandi[...] the topics. The work will be presented in a professional, structured manner and may inc[...] simple references.
	65	As above, but nearly all of the tasks will have a detailed and clear explanation.
	68	As above, but all of the tasks will have a detailed and clear explanation.

Grade band	Marks available	A description of work example
1st class	74	All tasks will have a detailed and clear explanation which demonstrates full understanding of the topic. There may be a few slight errors or minor missing details.
	80	As above, but of good quality throughout, without obvious errors or missing details.
	87	As above, but showing evidence of background reading through appropriate citing of sources. Discussed the result obtained from the model. Explained why it worked and what alternatives can be taken in the future to solve the given problem.
	94	As above, but ensuring that sources are of a good quality and used throughout the work.
	100	provides evidence of thorough independent research and development. Algorithms and techniques are tailored to the use case, and explanation of how and why this was done is provided. The submitted material makes it easy for a developer or user with a disciplinary background in computing to validate, test, employ, and further develop the code