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RESEARCH PROPOSAL FORM

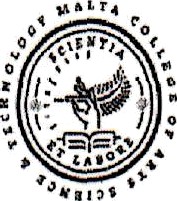
*(also referred to as the ‘Statement of Intent Form’, or S0l)*

*To* be *submitted by the* ***researcher to the* Institute** *Research* ***Sub-Committee (IRC)***

|  |  |
| --- | --- |
| Research **Title:**  Detecting and Classifying Fresh Spices Using Convolutional Neural Networks. | |
| **Institute name**  Institute of Information and Communication Technology | |
| Course / Programme:  Bachelor of Science (Honours) in Multimedia Software Development | |
| Level and year of study:  Level 6 Year 3 | |
| Main area **of study being proposed: Computer Vision/Object Detection**  This study will focus on a spice detection system using a computer vision model. The expectation is to for the system to achieve a high accuracy, precision, recall rate while still being able to classify the fresh spices by their unique visual features. To achieve these results, a deep dive into techniques and parameters of the model shall be taken to ensure that the system has the best possible configuration for the problem.  To achieve spice detection a deep dive into Convolutional Neural Networks must be taken. Kim, J.A., Sung, J.Y. and Park (2020) experimented on auto-mobile detection on multiple detection models to compare and evaluate which of them had the most promising results. “It can be seen that the recently released model, YOLO v4, has the best performance” was their concluding statement.  Continuing from the previous research result a study conducted by Wang, C.Y., Bochkovskiy, A. and Liao (2023) presented the new YOLOv7 model. They concluded that the new “You look only once” system achieved state of the art results, by significantly surpassing all other systems either in speed or average accuracy (AP) | |
| Name of Researcher:  Colton Sammut | Researcher’s I.D.  Number: 455803L |
| Signature of Researcher | **Date of submission of Form**  04/06/2023 |
| Name of Tutor (or Recommended Tutor):  Owen Sacco | |

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Throughout this decade, even though it just started multiple leaps in neural networks have been taken. This introduction to a new field that has been made available for students does interest me. More specifically I am interested in the inner workings of Computer Vision and how current advances corollate to the industry. Are Algorithms ready for certain parts of the industry? And in that case what approach should be taken to execute the task. Does computer vision solve a problem in the most efficient way or are there technological advances that are more suitable. For this, question to be answered we first need

to try out the computer vision approach.

Spices are one of the most used plants, that sometimes can be difficult to differentiate. Moreover, like and other ingredients that are used for cooking, such as mushrooms, they can be hard to identify from other poisons or harmful plants. Another issue that is worth mentioning is the verification of these spices in an

industrial setting, as it is a long and redundant task.

**Personal Motivation for the Choice of Research Theme.**

Firstly, to ensure spice detection is possible with CNN’s research on what has already been done needs

to be considered. Though this is a specific field detecting spices using advanced Al is not a completely new idea. Bhattacharya, S. and Mukherjee, J., (2020) presents a study about classifying Indian spices. The resulting accuracy from this study, is a high 96.7%. This study shows that a system like this can detect the change in color between different spices.

Sundaram, A., Masud, A., AlMarhoon, A. and Sarmah, B. (2022) proposed another system using a very important technique. This technique is called transfer learning in which, during training a generic pre- trained model is set in the parameter to achieve higher results. The results turned out to be an astounding 95% accuracy on an unseen dataset. Moreover, it had been clarified that there is lack of pre-made datasets and a dataset needed to be created. This point shall correlate to the methodology as an extra step needs to be taken to achieve our results.

**Outline of Key Literature and Theoretical Framework or Propositions.**

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The main problems that should be solved are Food Safety, Consumer Protection, and Industrial

Efficiency.

Since this system shall identify the spices, a user has a second opinion on what a plant could be and if it is edible. Moreover, the user cannot just be a person but a distributor which has large batches of these spices, which if investigated manually can result in a slow and redundant process. But this is why algorithms were invented to break down these processes and execute them in an efficient manner.

**Significance of the Study.**

*Hypothesis: Using Convolutional neural networks to detect spices could yield a new, cost effective and*

*simplistic way of identifying* spices. *Furthermore,* experimentation *techniques and training models could heighten the accuracy, precision, recall and classification of the system. Moreover, other factors such as Physical Positioning and Lighting effect the detection rate of the System.*

*Research* ***Questions:***

Which model meets the requirements of an effective CNN System for spice detection? What Parameters/Hyper Parameters are best suited for this task?

How does Physical factors effect the System, and how can they be eliminated? Does the final Prototype prove to be an effective solution?

**Hypotheses and/or Research Question/s**

* After the expected results are achieved, a field test using the detection model, from the training phase shall be used to determine if the system is useful in an industrial setting or if further medication and improvements are needed
* In the early stages of Development parameter usage and techniques shall be experimented on depending on the previous iteration’s results to improve the systems metrics.

To answer the aDove hypothesis and research questions, the below method shall be adopted.

* An evaluation of different CNN models shall be taken to ensure that the model being used is updated, and that shall give us the best possible results.
* During Development Images for the dataset shall be taken from a primary source rather from secondary one to ensure that consistency and Quality is not an issue. This shall also include some personal research on how to effectively take these images in the best possible way.

**Target Participants and Research Methods for Data Collection and Analysis**

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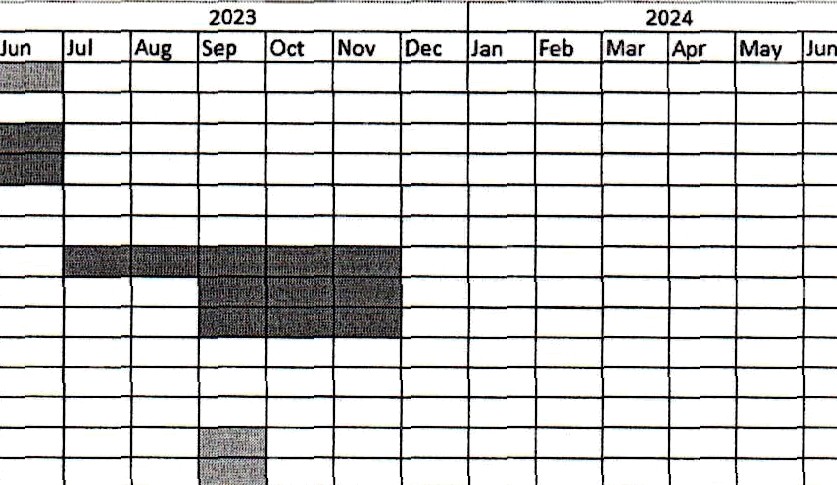
This study shall shed light on how versatile and valuable computer vision systems can be. Moreover, this study shall help businesses that are related to this topic to have an easy and accessible way to validate and detect spices, as fraud can be found anywhere in an industrial setting. Furthermore, it shall also display the effectiveness of how CNN model can catch minute details such as the shape of a leaf.

Anticipated Contributions of the Study.

Dissertation Project Plan.



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3.2 Pipeline

4.2 Internal Testin



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| **Ethical Considerations.**  Refer to *guidance R• ints below. You* ***are also additionally*** *required* ***to read MCAST*** *Document 074 ’Research* ***Ethics*** *Policy and Procedure’ that is available on* tfte *College website*  *Research shall be conducted in such a manner so as* to *avoid any psychological and physical harm* to *humans and*  *animals and financial damage to organizations:*   1. *Only the* supervisor *and examiners will have access to any data gathered.* 2. *Padicipants will remain free* to *withdraw from the study at any time without having to provide any reason. In the case of withdrawal, all the records and information collection will be deleted.* 3. *The padicipant, who is the sole proprietor of the data provided, is granting that such data*   *would be processed for this study purposes only.*   1. *The data collection process will be a transparent process.* 2. *All transcriptions and/or electronic recordings reflecting the data collected, once exhausted, are to be deleted* 3. *Confidentiality, anonymity and data protection procedures* are *to be ethically abided by.* 4. *The researcher would provide a* soft *copy of the study to the padicipant, if required.* |
| *Enter details here regarding possibility of issues regarding confidential personal data:*   * To ensure that no copyright/Trademark violation is taken all images and materials used in a dataset will be from primary sources or from open-source images. * All CNN models used in the research shall be credited with their respective developers. |
| *Enter details here regarding possibility of physical harm:*  Due to the core components needed for this research are either programs or plants, and no direct connections with humans or animals shall be made, I see no possibility of physical harm. |

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| *Enter details* here *regarding possibility of moral harm:*  Due to the core components needed for this research are either programs or plants, and no direct  connections with humans shall be made, I see no possibility of psychological harm or cultural disrespect. |
| *Enter details here regarding possibility of business harm:*  Due to the core components needed for this research are either programs or plants, and no direct connections with businesses shall be made, I see no possibility of harming a business or organization. |

*Please see Annex 1 for a sample Participant Information Letter and Annex 2 for a sample Padicipant Consent Form. Student is to submit a copy of the proposed Participant Information Letter and Padicipant Consent Form where applicable. Both documents should be attached to the end of the SOI that is being submitted by the student.*

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List of Key References:

Kim, J.A., Sung, J.Y. and Park, S.H., 2020, November. Comparison of Faster-RCNN, YOLO, and SSD for real-time vehicle type recognition. In *2020 IEEE international* conference on *consumer* e/ecfronics-Asia *(lCCE-Asia)* (pp. 1-4). IEEE.

Wang, C.Y., Bochkovskiy, A. and Liao, H.Y.M., 2023. YOLOv7: Trainable bag-of-freebies sets new state-of-the-art for real-time object detectors. In *Proceedings of the IEEE/CVF Conference on Computer* Vision *and Pattern Recognition* (pp. 7464-7475).

Bhattacharya, S. and Mukherjee, J., 2020. Recognition of Indian Spices based on the Combination of Features and Comparison using Neural Network. *Research Journal of Engineering and Technology (IRJET),* 7(06).

Sundaram, A., Masud, A., AlMarhoon, A. and Sarmah, B., 2022. TRANSFER LEARNING APPROACH FOR CLASSIFICATION OF WIDELY USED SPICES. *Yanbu Journal of Engineering and Science, 1s(2),* p.35690.

*This section is to be* ii//ec/ *in by the refi›resentative of* I/ie *Institute Research* Set-Committee *(IRC) prior to forwarding of this Form to* fhe *’MCAST Research Ethics* Comm/ttee’ *for final ethics approval:*

|  |  |  |
| --- | --- | --- |
| *Nature* of *Et/Rica/*  Consideration | Otztcome  ***(Tich)*** | Comments/Ar/y/ce |
| All ethical issues have been adequately tackled. |  |  |
| Possibility of issues regarding  misuse of data or some form of harm. |  |  |

|  |  |
| --- | --- |
| Details of Representative to the Institute Research Sub-Committee. | |
| Name | Signature |
| Designation | Date |

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### Annex 1: Participant Information Letter

*Sample:*

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Title of Research:

You are being invited to take part in a research study. Before you decide to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information.

What is the purpose of the study? This research is being undertaken on...

Why have I been chosen?

You have been chosen because...

Do I have to take part?

It is up to you to decide whether or not your take part. If you decide to take part you will be given this information sheet to keep and be asked to sign a corresponding consent form.

What will happen to me if I take part†

You will then be given a questionnaire on.../your data will be used.../your image will be used...

What are the possible disadvantages and risks of taking part?

There are no disadvantages or risks foreseen in taking part in the study.

What are the possible benefits of taking part†

By taking part you will be contributing to the development of a set of recommendations for...

What if something goes wrong†

If you wish to complain or have any concerns about any aspect of the way in which you have been approached or treated during the course of this study, please contact...(researcher is to give his/her MCAST email as a contact)

Will my details be kept **confidential†**

All information which is collected about you during the course of the research will be kept strictly confidential so that only the researcher carrying out the research will have access to such information and will not be shared with any other individuals. Participants should note that data/images collected from this project may be retained and published in an anonymized form. By agreeing to participate in this project, you are consenting to the retention and publication of data.

What will happen to the **results of the research study†**

The results will be written up into a dissertation for my final project of my Bachelor...

Who is organizing the research?

The research is conducted as part of a degree in ...

Who may I contact for further information†

If you would like more information about the research before you decide...(researcher is to give his/her MCAST email as a

contact)

*Thank you for your interest in this research. . .*

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#### Annex 2: Participant (or Guardian) Consent Form

*Sample:*

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#### Title of Research: Name of Researcher:

Please initial box

#### I confirm that I have read and understand the Information Letter

for the above study and have had the opportunity to ask questions.

#### I understand that my/my charge’s participation is voluntary and that I/my charge am/are free to withdraw at any time without giving any reason.

1. I agree to allow my daughter/son/charge to take part in the above study.

##### (Statement 3 is fo be included only when guardians/parents are involved in giving consent)

Name of Participant/ Guardian

Researcher

*1 for participant, 1 for researcher*

*MCAST Controlled and* approved *document*

Date

Date

Signature

Signature

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