**Ethical Approval for Non-Clinical Research Involving Human Participants**

**FORM B: Application for ethical approval for medium/high-risk projects**

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| Name of Applicant | Dhanashree Arun Nangre |
| School | School of Science and Engineering |
| Division/Programme | Master’s in data science and engineering |
| University e-mail Address | 2544403@dundee.ac.uk |
| Title of Project | Comparing the Quality of Fingerprint Images |
| Co-Investigators (with internal School or external organisational affiliation) | N/A |
| Projected Start Date | January 16,2024 |
| Estimated End Date | April 27, 2024 |
| Funder (if applicable) | N/A |
| Version of Application (1, 2, 3…)\* | 2 |

\* After revision, please update the version number before re-submission.

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| **Students Only** |  |
| Level of Study (Undergraduate (UG); Taught Postgraduate (TPG); Research Postgraduate (RPG) | Taught Postgraduate |
| Name of University of Dundee Supervisor | Oluwafemi Samuel |

**Note: Students must copy their supervisor when submitting the application for review.**

**1. Project Information**

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| 1a. Please provide, with reference to the relevant literature, an overview of the research project providing a short explanation maximum 400 words) of the research questions the project will address and why the study is justified.  Assessing the quality of fingerprint images obtained by different sensors, such as optical, capacitive, solid-state, and light-emitting sensors, is a key component of fingerprint recognition research. This evaluation is important since it establishes how well recognition algorithms match fingerprint samples. Maintaining high-quality photos is crucial to preventing expensive operational setting mismatches. Researchers undertake comparison analyses in order to improve the accuracy and reliability of quality evaluation tools across various sensor types. The objective of this project is to use existing datasets to compare the quality of fingerprint photos taken by a light emitting sensor (LES) and an optical sensor. The fingerprint quality will be calculated using the NFIQ assessment tool. NFIQ is a widely used fingerprint image quality assessment tool developed by the National Institute of Standards and Technology (NIST) and has been a benchmark for assessing the performance of fingerprint image quality tools. This research should answer following research questions which should help understand how to compare and analyse fingerprints quality and enhance fingerprint images.   1. How does the quality of fingerprint images captured by an optical sensor compared to those captured by a light-emitting sensor (LES)? 2. How do common metadata elements influence the quality assessment results for both optical and light-emitting sensors? 3. Can an optimal set of metadata parameters be identified that enhances the accuracy of quality assessments for both optical and light-emitting sensor? 4. What are the challenges associated with the image resolution and format constraints imposed by the NFIQ assessment too? 5. What practical workarounds can be devised to address potential constraints related to image resolution and format imposed by the NFIQ assessment tool?   References   1. F. Alonso-Fernandez, J. Fierrez and J. Ortega-Garcia, "Quality Measures in Biometric Systems," in IEEE Security & Privacy, vol. 10, no. 6, pp. 52-62, Nov.-Dec. 2012, doi: 10.1109/MSP.2011.178. 2. K. A. Yusharyahya, A. S. Nugroho, J. Purnama and M. Galsinium, "A comparison of fingerprint enhancement algorithms for poor quality fingerprint images," 2014 International Conference of Advanced Informatics: Concept, Theory and Application (ICAICTA), Bandung, Indonesia, 2014, pp. 342-347, doi: 10.1109/ICAICTA.2014.7005966. 3. NFIQ2 (National Institute of Standards and Technology (NIST) Fingerprint Image Quality Tool), https://www.nist.gov/services-resources/software/nfiq-2 |
| 1b. What are the aims and objectives of the project?  This project aims to provide insights into fingerprint quality assessment by comparing different sensors and evaluating with NFIQ tool. Additionally, it seeks to identify the influence of metadata on fingerprint images, address challenges with image resolution constraints, and propose practical solutions for optimizing fingerprint quality assessments.   1. Compare the quality of fingerprint images obtained from an optical sensor and a light emitting sensor (LES). 2. Investigate the influence of common metadata elements on quality assessment results for optical and light emitting sensors. 3. Determine an optimal set of metadata parameters to enhance the accuracy of quality assessments for both sensor types. |
| 1c. Please describe the design of your study and the research methods including information about any tasks or measuring instruments (validated or otherwise) that you will be using. *If you are using non-validated instruments (e.g., surveys or questionnaires[[1]](#footnote-1) you have designed, interview questions, observation protocols for ethnographic work or topic lists for unstructured data collection) please attach a copy to this ethics application.*  In this study I’ll be comparing and analysing fingerprint images captured by two different fingerprint scanners that are light emitting scanners and optical fingerprint scanner. MASIVE dataset which was collected using light emitting fingerprint scanner contains fingerprint images of Nigerian volunteers with age range from 18 to 99 years. It contains metadata including age groups, gender, residence (urban or rural), occupation type, physical conditions of fingertips, history of verification difficulties at elections, environmental conditions (temperature and humidity). MASIVE is yet to be published but is currently under review for publication. The dataset was collected following the approval of the Ethics Committee of the School of Science and Engineering and the ethics approval covers sharing it with the scientific community for the purpose of research that is related to the reason for which it was collected i.e. fingerprint recognition (including quality assessment).  In applying for access to the dataset, one of the requirements is the evidence of ethics approval (by the applicant’s institution) of the research for which the application is made.  The second dataset SOCOFing has data around 820 MB which has metadata related to gender and finger type was collected using optical fingerprint scanner. SOCOFing on the other is publicly available and does not require ethics approval for access and usage.  I’ll be working with these datasets and analysing it using NFIQ2 tool. NFIQ2 (National Institute of Standards and Technology Fingerprint Image Quality) assesses image quality by assigning a numerical score that reflects the overall quality of the image. NFIQ2 documentation can be found here: https://www.nist.gov/services-resources/software/nfiq-2. The overarching aim is to investigate how the metadata about the fingerprints and the sensors used for their collection could affect the quality of the fingerprint images as represented by the NFIQ scores. I will also check if there are any series of steps that can be taken to enhance the quality. |

**2. Participants**

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|  | YES | NO |
| 2a. Will your research involve children under the age of 16[[2]](#footnote-2)?\* |  | X |
| 2b.Will your research involve the recruitment of vulnerable participants (for example, participants with learning difficulties, disabilities, members of marginalised communities, people involved in illegal activities such as drug abuse?\* |  | X |
| 2c. Will your research involve participants with communication difficulties, including difficulties arising from limited facility with the English language?\* |  | X |
| 2d. Will your research involve participants in unequal relationships with the researcher(s) (e.g., your own students)? |  | X |
| 2e. Will your research involve participants outside of the UK? |  | X |

\* If you answered YES to question(s) 2a, 2b or 2c please attach a copy of your Protecting Vulnerable Groups (PVG) clearance from [Disclosure Scotland](https://www.mygov.scot/organisations/disclosure-scotland/) (or the equivalent in other jurisdictions).

Please explain in detail how you intend to recruit your participants (including inclusion and exclusion criteria and the participant’s location if outside the UK). Pay particular consideration to any issues arising from answering YES to any of these questions:

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| This project does not require recruitment of participants because existing datasets would be used. The first dataset consists of fingerprint images of Nigerians who live in Nigeria and are above 18 years. As the data has already been collected by my supervisor (Oluwafemi Samuel) with all required permissions, I’ll be using the same dataset so there won’t be any new data collection.  The second dataset, SOCOFing is publicly available fingerprint dataset at Kaggle.com.  As MASIVE dataset was collected using light emitting sensor, I’ll run quality check on images using NFIQ2 tool and analyse the quality score compared to quality score of images in SOCOFing which was collected using an optical sensor. |

**3. Informed consent**

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|  | YES | NO |
| 3a. Will all participants be fully informed why the project is being conducted and what their participation will involve, and will this information be given before the project begins? | N/A |  |
| 3b. Will every participant be asked to give written consent to participation? | N/A |  |
| 3c. Will all participants be fully informed about what data will be collected, [where and for how long it will be stored](https://www.dundee.ac.uk/corporate-information/forms-and-b-additional-guidance-data-management), and their rights under data protection legislation? | N/A |  |
| 3d. Will all participants be informed who has access to their data during the time it is stored? | N/A |  |
| 3e. If the project involves audio, video or photographic recording of participants will explicit consent be sought?[[3]](#footnote-3) | N/A |  |
| 3f. Will every participant understand their right not to take part or to withdraw themselves and their data from the project without giving a reason and without penalty? | N/A |  |
| 3g. If the project involves deception or covert observation of participants will you debrief them at the earliest possible opportunity? | N/A |  |
| 3h. Will participants be fully informed about the potential [reuse of their data](https://www.dundee.ac.uk/corporate-information/forms-and-b-additional-guidance-data-management) by other researchers? | N/A |  |
| 3i. If required, will you obtain permission from relevant authorities (e.g. employers, third sector organisations, government institutions) as part of the recruitment process? | N/A |  |
| 3j. Are you satisfied that all participants have capacity to make their own decisions and understand the risks? | N/A |  |

If you answered YES to ALL of these questions, please explain briefly how you will implement the informed consent scheme. *Please attach copies of the participant information sheet(s) and consent form to your application.*

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If you answered NO to ANY of these questions, please provide an explanation. Please note that if written consent is not obtained, any other form of consent used must involve a deliberate action to opt-in (for example, in surveys or questionnaires).

*Please attach a copy of the participant information sheet and consent form (where applicable) to your application.*

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**4a. Data Management: Lawful Processing of Data**

1) Data protection legislation[[4]](#footnote-4) requires participants to be informed of the [lawful basis](https://ico.org.uk/for-organisations/guide-to-the-general-data-protection-regulation-gdpr/principles/lawfulness-fairness-and-transparency/) for processing their personal data. At the University of Dundee, the normal basis for the lawful processing of personal data in research is that 'processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller'. If you intend to use another lawful basis you must contact the University’s Data Protection Officer (DPO) for advice and insert the lawful basis agreed with the DPO below.

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| University of Dundee’s lawful basis will be used for this research. |

2) In addition to the lawful basis above, where the research involves the processing of special category[[5]](#footnote-5) (sensitive personal) data, participants must be informed of the [specific condition](https://ico.org.uk/for-organisations/guide-to-the-general-data-protection-regulation-gdpr/lawful-basis-for-processing/special-category-data/) under which this processing will be performed. At the University of Dundee, the specific condition for the lawful processing of special categories of personal data in research is normally that 'processing is necessary for archiving purposes in the public interest, scientific or historical research purposes or statistical purposes’. If you will be processing special category data and intend to use another condition you must contact the University’s Data Protection Officer (DPO) for advice and insert the condition agreed with the DPO below.

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| The lawful basis for processing special category of data for this research is the same as the  University of Dundee’s. |

**4b. Data Management: Planning**

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|  | YES | NO |
| 4a. Are there any reasons why you cannot guarantee the full security and confidentiality of any personal or confidential data collected for the project? |  | X |
| 4b. Is there a possibility that any of your participants, organisations they are affiliated with, or people associated with them, could be directly or indirectly identified in the outputs from this project? |  | X |
| 4c. Will any personal or confidential data be retained at the end of the project other than in fully anonymised form? |  | X |
| 4d. Will it be possible to link information or data back to individual participants in any way (include consideration of the use of [secondary data](https://www.dundee.ac.uk/corporate-information/forms-and-b-additional-guidance-data-management))? | X |  |

If you have answered YES to ANY of these questions, please explain why it is necessary to breach normal ethical procedures regarding confidentiality, security and/or retention of research data.

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| * Participants can be identified using the fingerprints from either of the datasets that have been chosen for this research, but this will a difficult task because these are anonymised fingerprint images. * It would take having another identified sample of each participant’s fingerprints to be able to link their collected fingerprint images specifically to them. * Although this might not be considered a serious risk as such, it is still a potential risk and should not be ignored as part of risk assessment. It can only happen if an identified sample of participants fingerprint is available for matching which would not be trivial. |

Irrespective of your answers to questions 4a to 4d, please describe your plan for managing the data[[6]](#footnote-6) you will collect during your project and how it complies with data protection legislation. Include information on: i) The type and volume of data[[7]](#footnote-7); ii) Where and for how long will the data be stored and what measures will be in place to ensure secure storage[[8]](#footnote-8); iii) Whether the data will be anonymised or pseudonymised[[9]](#footnote-9); iv) How secure access will be provided to data for collaborators; v) Whether and how data will be shared for [reuse](https://www.dundee.ac.uk/corporate-information/forms-and-b-additional-guidance-data-management) by other researchers beyond the project (including details on any access restrictions); vi) Processes in place to erase and/or stop processing an individual participant’s data (except where this would render impossible or seriously impair the research objectives)[[10]](#footnote-10); vii) Processes in place for individuals to have inaccurate personal data rectified, or completed if it is incomplete; viii) Who has overall responsibility for data management for the research project; ix) [Arrangements for collection and transfer of data outside the UK](https://www.dundee.ac.uk/corporate-information/forms-and-b-additional-guidance-data-management).

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| * Complete MASIVE dataset- Fingerprints images and metadata in gigabytes and megabytes respectively, and SOCOFing which is publicly available on Kaggle.com- 820 MB * MASIVE dataset is currently deposited on the University’s repository. Upon getting access to it, it will be stored in local machine that is provided and managed by the University. I will be using NFIQ assessment tool to work with data, and some python scripts written by me. All this process will be carried out on a University-managed passphrase-protected machine. * The data will always be accessed in a secure manner. It will not to be accessed in public places where it can be viewed by others. The data will not be accessed or sent to non-University systems or services (personal email accounts, cloud storage products etc). Off-campus access will require the use of MyDesktop a two-factor authentication to access the data on OneDrive. * Data will be erased after the project has been examined and machine used will be returned to the University. * There will be no need to update the data. * The data will not be shared with anyone. Only the results of research will be included in project report, and this will contain no information that would make any of the participants identifiable. |

**5. Risk of harm to researchers and participants**

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|  | YES | NO |
| 5a. Is there a risk that the project may lead to physical discomfort or pain for the participants? |  | X |
| 5b. Is there a risk of emotional or psychological distress to participants? |  | X |
| 5c. Will your research involve the use of tissue samples (including blood and biopsies from healthy volunteers) excluding use for genetic analysis only or tissues obtained from a tissue bank? |  | X |
| 5d. Will the research involve psychological intervention? |  | X |
| 5e. Will the research involve working with any substances and/or equipment which may be considered hazardous? |  | X |
| 5f. Will the study involve discussion of sensitive or potentially sensitive topics (e.g., sexual activity, drug use, personal lives)? |  | X |
| 5g. Is there a risk that the safety of the researcher may be compromised (e.g., lone working, working in potentially dangerous environments), i.e. does the research incur a risk of injury or ill-health above the level of risk prevalent in daily living? |  | X |
| 5h. Does the research involve fieldwork outside the UK? |  | X |

If you answered YES to ANY of these questions, please explain the nature of the risks involved, why it is necessary to expose the participant or researcher to such risks, how you propose to assess, manage and mitigate the identified risks and how you plan to communicate the risks and your plans for mitigation to the participants. Please also explain the arrangements you will make to refer participants or researchers to sources of help or advice if they are distressed or harmed as a result of taking part in the project. *Where the research incurs a risk of injury or ill-health above the level of risk prevalent in daily living the relevant risk assessment form(s) (*[*general risk assessment form*](https://www.dundee.ac.uk/safety/policy/general/spa11-2002/) *and/or the risk assessment for* [*Travelling on University Work Overseas*](https://www.dundee.ac.uk/safety/policy/general/spa44-2010/)*) should be submitted with this application.*

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| As the data is already collected, this is not applicable. |

**6. Risk of disclosure of harm/potential harm or of criminal offences**

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|  | YES | NO |
| 6a. Is there a risk that the study will lead participants to disclose evidence of previous criminal offences, or their intention to commit criminal offences? |  | X |
| 6b. Is there a risk that the project will lead participants to disclose evidence that children or vulnerable adults are being, or have been, harmed, or are at risk of harm? |  | X |
| 6c. Is there a risk that the study will lead participants to disclose evidence of serious risk of other types of harm? |  | X |

If you have answered YES to ANY of these questions please explain why it is necessary to take the risk of potential or actual disclosure and what actions you would take if such disclosures were to occur. Please explain what advice you would take from whom before taking these actions and what information you will give participants about the possible consequences of disclosing such information.

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| N/A |

**7. Payment of participants**\*

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|  | YES | NO |
| 7a. Do you intend to offer participants cash payments or any other kind of inducements for taking part in your project? |  | X |
| 7b. Is there a possibility that such inducements will cause participants to consent to risks that they might not otherwise find acceptable? |  | X |
| 7c. Is there any risk that the prospect of payment or other rewards will systematically skew the data? |  | X |
| 7d. Will you inform participants that accepting compensation or inducements does not negate their right to withdraw from the study? |  | X |

\* Typically small sums or vouchers to compensate participants for out of pocket expenses such as travel and subsistence and for time spent/inconvenience.

If you have answered YES to ANY of these questions, please explain the nature of the inducement or amount of payment you will offer and the reason why it is necessary to offer inducements. You should also explain why you consider it ethically and methodologically acceptable in the context of this study to offer such payments or other inducements.

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| N/A |

**8. Voluntary participation**

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|  | YES | NO |
| 8a. Will you recruit students or employees of the University of Dundee or of organisations that are formally collaborators in the study and who will be in an unequal relationship with you or the researchers affiliated with the project? |  | X |
| 8b. Will you recruit participants who are employees recruited through other businesses, voluntary or public sector organisations? |  | X |
| 8c. Will you recruit participants who are pupils or students recruited through educational institutions? |  | X |
| 8d. Will you recruit participants who are clients recruited through voluntary or public services? |  | X |
| 8e. Will you recruit participants who live in residential communities or institutions? |  | X |
| 8f. Will you recruit participants who may not feel empowered to refuse to participate in the research? |  | X |

If you have answered YES to ANY of these questions please explain how your participants will be recruited and what steps you will take to ensure that participation in this project is genuinely voluntary.

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| N/A |

**9. Any Other Ethical Considerations**

Are there any other ethical considerations relating to your project which have not been covered above? If so, please explain.

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| N/A |

**10. Documentation**

Please list all attached documentation, ensuring that each item has a date and version number.

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| 1. Non-Clinical-Research Ethics CHECKLIST-1 2. Non-Clinical Research Ethics CHECKLIST-2 3. SSEN Risk Assessment Form for Student Projects |

**11. Declaration**

By signing below I declare that I have read the University [Policy for non-clinical research involving human participants](https://www.dundee.ac.uk/corporate-information/policy-non-clinical-research-involving-human-participants) and that my research abides by these guidelines. I understand that this application and associated documents will be retained by the University.

**Principal Investigator or Student**

Name: Dhanashree Nangre Date: 06/02/2024

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**Supervisor (for applications from students)**

Name: Oluwafemi Samuel Date: 12/03/2024



Signature:

1. Please provide details of any survey tools you intend to use. The University approved online survey tool is ‘[Online surveys](https://www.onlinesurveys.ac.uk/)’ (formerly BOS). If you intend to use a different survey tool please indicate the reason. [↑](#footnote-ref-1)
2. The legal age of capacity in Scotland is 16 under [The Age of Legal Capacity (Scotland) Act 1991](https://www.legislation.gov.uk/ukpga/1991/50/contents). The legal age of capacity in other jurisdictions should be checked if your research involves participants in other parts of the UK and/or internationally. [↑](#footnote-ref-2)
3. Where applicable, this should include consent for someone not on the direct research team to have access to the participant’s data, e.g. for transcription. [↑](#footnote-ref-3)
4. The General Data Protection Regulation ((EU) 2016/679) and the UK Data Protection Act (2018). Further information can be obtained from the [University of Dundee data protection website](https://www.dundee.ac.uk/information-governance/dataprotection/) and the [website of the Information Commissioner’s Office](https://ico.org.uk/). [↑](#footnote-ref-4)
5. Special category data is sensitive personal data belonging to the following categories: racial or ethnic origin; political opinions; religious or philosophical beliefs; trade union membership; genetics, biometrics; health; sex life; or sexual orientation. [↑](#footnote-ref-5)
6. Note that staff and postgraduate research students are required to complete a research data management plan under the University of Dundee’s Policy to Govern the Management of Research Data. However, providing you have included the information requested above, it is not necessary to attach a formal data management plan to this application. [↑](#footnote-ref-6)
7. If your research involves high-risk or high-volume *processing* of personal data you will be required to complete a Data Protection Impact Assessment for your project. Please consult the University’s [data protection pages](https://www.dundee.ac.uk/information-governance/dataprotection/) and [Data Protection Officer](mailto:dataprotection@dundee.ac.uk) for advice. [↑](#footnote-ref-7)
8. Please consult [the Information Security Classification Scheme](https://www.dundee.ac.uk/corporate-information/information-security-classification-scheme) on the University’s [data protection pages](https://www.dundee.ac.uk/information-governance/dataprotection/) for guidance. [↑](#footnote-ref-8)
9. (Article 4(5) of the General Data Protection Regulation describes pseudonymisation as: “The processing of personal data in such a way that the data can no longer be attributed to a specific data subject without the use of additional information”. An example would be where a coded reference or pseudonym is substituted for personally identifiable data. [↑](#footnote-ref-9)
10. The right to erasure under the General Data Protection Regulation does not apply if erasing the data would prejudice scientific or historical research, or archiving that is in the public interest. [↑](#footnote-ref-10)