**MSc. in Computing**

**Practicum Approval Form**

# Section 1: Student Details

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| Project Title: | Analysis of relationship between human activities and stress using deep learning models and explainable AI |
| Student ID: | 23268158, 23260426 |
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| Chosen major: | Data Analytics |
| Supervisor | Liting Zhou |
| Date of Submission | 24th November 2023 |

# Section 2: About your Practicum

**What is the topic of your proposed practicum?**

This project aims to provide valuable insights into the intricate relationship between lifestyle choices and mental health. This will allow users to avoid stressful activities and make better choices for their mental wellbeing and quality of life. We propose to find the connection between daily activities and emotions, stress levels and fatigue logged by users. Early prediction of stress allows individuals to take preventive measures to manage and reduce stress before it escalates into more serious mental health issues. The data we will be using was collected from a survey that users were asked to fill twice a day during the period in which they participated in the experiment.

**Please provide details of the papers you have read on this topic**

1. Yamamoto, Tetsuya, y Yoshimoto, Junichiro, y Murillo-Rodriguez, Eric, y Machado Sergio. "Prediction of daily happiness using supervised learning of multimodal lifelog data." Revista Psicologia e Saúde, vol. 11, no. 2, 2019, pp.145-152. Redalyc, [[link](https://www.redalyc.org/articulo.oa?id=609863969012)]
2. Soleimaninejadian, Pouneh, et al. "Mood detection and prediction based on user daily activities." *2018 First Asian Conference on Affective Computing and Intelligent Interaction (ACII Asia)*. IEEE, 2018. [[link](https://ieeexplore.ieee.org/abstract/document/8470365/)]
3. Dobbins, Chelsea, et al. "A lifelogging platform towards detecting negative emotions in everyday life using wearable devices." *2018 IEEE International Conference on Pervasive Computing and Communications Workshops (PerCom Workshops)*. IEEE, 2018. [[link](https://ieeexplore.ieee.org/abstract/document/8480180/)]
4. Chua, Sook-Ling, Lee Kien Foo, and Hans W. Guesgen. "Predicting activities of daily living with spatio-temporal information." *Future internet* 12.12 (2020): 214. [[link](https://www.mdpi.com/1999-5903/12/12/214)]
5. Soleimaninejadian, Pouneh, et al. "THIR2 at the NTCIR-13 Lifelog-2 Task: Bridging Technology and Psychology through the Lifelog Personality, Mood and Sleep Quality." *NTCIR*. 2017. [[link](https://www.researchgate.net/profile/Pouneh-Soleimaninejadian-2/publication/322162927_Bridging_Technology_and_Psychology_through_the_Lifelog_Personality_Mood_and_Sleep_Quality/links/5a8442c50f7e9b2c3f4ff3c7/Bridging-Technology-and-Psychology-through-the-Lifelog-Personality-Mood-and-Sleep-Quality.pdf)]

**How does your proposal relate to existing work on this topic described in these papers?**

Daily activities can have a significant impact on stress levels. The relationship between daily activities and stress is complex and individualized, as people respond differently to various stimuli. However, some general patterns can be observed regarding how certain activities may influence stress. This will help recommend activities that would reduce stress and enhance general wellbeing.

The previous work assesses the values of various biological signals like heart rate, galvanic skin resistance, diet (calorie intake), etc to predict values of stress and fatigue. We propose to use the activities performed and data about the activities themselves, to predict levels of stress and fatigue experienced at the end of the day.

**What are the research questions that you will attempt to answer?**

Understanding the nuanced impact of various daily activities on stress is crucial for developing targeted stress management strategies. How does the nature and intensity of each activity influence the stress levels of individuals, and to what degree do these stressors accumulate throughout the day? Delving into the intricacies of activities, it's essential to explore the characteristics that differentiate stress-alleviating activities from stress-inducing ones. What specific qualities contribute to a positive effect on stress, and conversely, what aspects of certain activities may exacerbate stress and lead to increased fatigue? Understanding these distinctions is pivotal for tailoring interventions.

The research questions we are attempting to answer are:

1. Comparing the accuracy of prediction of stress levels using deep learning methods based on daily human activities.
2. To what extent does each daily activity contribute to the overall stress experienced by an individual using explainable AI algorithms? What kind of activities have a positive effect or negative effect on stress and fatigue?

**How will you explore these questions?**   
  
1. **What software and programming environment will you use?**

To answer our proposed question, we will employ the use of python, due to the extensive library available for data visualization, processing and machine learning. Additionally, we will use google collab, since it provides a convenient and accessible environment for running Python code.

**- What coding/development will you do?**

We will implement our model using LSTM and CNN algorithm with python to check which algorithm gives us a better accuracy score. Additionally we will apply LIME algorithm to check what feature contributes the most to stress levels.

**- What data will be used for your investigations? Is this data currently available, it not, where will it come from?**

We will be using the publicly available ETRI Lifelog dataset, this dataset includes 570 days of experimental sessions, about 7,350 hours of data from 22 subjects. It contains physiological data such as PPG, EDA, and skin temperature from a wrist-worn sensor, in addition to the multivariate behavioural data such as IMU and GPS data. The dataset consists of 440,830 processed labels that comprehend a broad range of everyday activities (including mode of transportation) and contextual information such as semantic places and social states. [[link](https://nanum.etri.re.kr/share/schung/ETRILifelogDataset2020?lang=En_us)]

**- What experiments do you expect to run?**

Training and testing machine learning model using, activity data, activity conditions, sleep data, emotions and fatigue levels to evaluate factors effecting stress levels.

**- What output do you expect to gather?**

We expect to predict stress levels, which will further help us analyse what kinds of activities have a positive or negative effect on stress.

**- How will the results be evaluated?**

We will evaluate the results of our experiment based on the accuracy, precision, recall and F1 scores of the algorithms.