Section 1 – *Supervisor Information*

First Supervisor (Name and Title)	Effie Law, Professor in Human-Computer Interaction		
Department/School	Informatics		
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Proposed Second Supervisor	Dr. Huiyu Zhou (Associate Professor in AI & Machine Learning)		
Department/School	Informatics		
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Section 2 – *Project Information*

Project Title:	Vocal Emotions Analysis of Conversations for Supporting Emotional Wellbeing	
Project Highlights:	1.	Child and adolescent wellbeing
	2.	Automatic voice emotion recognition
	3.	Integration of Experience-centred Design and Machine Learning methods to enhance parent-child communication with the goal of improving children's wellbeing.

Project Overview

The main goal of the PhD project is to develop and validate an application that is aimed to support parents to perceive their children's vocal emotional signals accurately during parent-child conversations. Parents are thus enabled to provide emotionally-sensitive matched responses to engage children in open and desirable conversations on a range of topics, from everyday experiences to critical issues. Provision of this parenting support will contribute to children's emotional wellbeing and mental health. The support is to be achieved by tackling two major challenges: (i) the development of effective machine learning (ML) models for automatic analysis of vocal emotions of both parent and child; (ii) the design of a usable and useful voice-sensor wearable device VoiceEmo into which the ML models are integrated to present instantaneous and meaningful vocal emotions analysis results and implications to its users for regulating their emotions and behaviours, when applicable.

Three main research questions (RQs) of the project are:
RQ1: How to maximise the accuracy and speed of real-time automatic emotion analysis with advanced Machine Learning methods?
RQ2: How to provide meaningful and timely recommendations to parents on their emotion regulation?
RQ3: How effective is the voice-based intervention in enhancing emotional wellbeing of typically developing children?

Tentative Project Methodology, Critical Skills and Training and Development

Methodology:
Year 1-2: To address the lack of emotional corpus on parent-child dialogues (a basic component for ML), the initial phase will focus on collecting such dialogues in a range of naturalistic and lab-based settings where parents and children converse on mundane and sensitive topics. Based on raw data, vocal emotion detection training models with different ML approaches will be developed and optimised.

Year 2-3: To develop a prototype of the voice-sensor wearable device with the participatory design approach, involving parent-child dyads over time. Real-time and offline access to results of voice emotion analysis will be supported. Given the participation of children and the issue of privacy, specific strategies on ethics will be developed.

Year 3: To evaluate the accuracy of the ML methods with real-life testing data and to validate the effectiveness and acceptance of the prototype for training parents. Field studies in natural settings (e.g. home) and lab-based studies will be carried out.

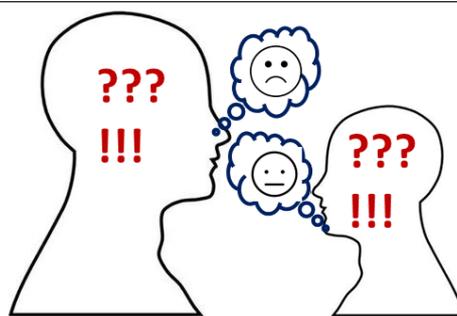**Skill development and training opportunities:**
- Research methods in Human-Computer Interaction (HCI): Participatory Design, Usability and User Experience evaluation, Multivariate statistical analysis, Qualitative data analysis
- State-of-the-art machine learning methods
- Child psychological development
- Research ethics

Indicative Student Profile
- MSc degree in computer science/informatics   - Good knowledge in machine learning methods (essential)   - Basic knowledge of Human-Computer Interaction, especially interaction design (essential)   - Fluent spoken and written English (essential)   - Experience of working with children (desirable)

| Further Reading: | Scherer, K. R. (2003). Vocal communication of emotion: A review of research paradigms. *Speech communication, 40*(1), 227-256. Choi, Y., Jeon, Y-M., Wang, L., Kim, K. (2017). A biological signal-based stress monitoring framework for children using wearable devices. *Sensors, 17*, 1936; doi:10.3390/s17091936. Poria, S., Cambria, E., Bajpai, R., & Hussain, A. (2017). A review of affective computing: From unimodal analysis to multimodal fusion. *Information Fusion, 37*, 98-125. |
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