Université de technologie de Compiègne – Thesis proposal

<table>
<thead>
<tr>
<th>Part 1: Scientific sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thesis proposal title</td>
</tr>
<tr>
<td>PhD grant</td>
</tr>
<tr>
<td>Research laboratory</td>
</tr>
<tr>
<td>Thesis supervisor(s)</td>
</tr>
<tr>
<td>Scientific domain(s)</td>
</tr>
</tbody>
</table>
| Research work            | Face detection and recognition have been an important issue for public safety and security. The detection of abnormal behavior of the involved subject could lead to anticipate his (her) intentionally indiscriminate violence actions. Airport face recognition platforms have been deployed to maximize safety and security at airports. This kind of system could be also deployed in public spaces to detect threats and suspected people. Biometrics (e.g. 2D facial measurements on the eyes, nose, chin, eyebrows and others) have been used for detection and recognition purposes. These features lead commonly to a satisfied accuracy level [1]. However, to analyze the subject behavior, manual and visual tracking task is usually performed. This task is subjective and very time-consuming. Furthermore, it is still hard to analyze the facial behaviors without knowledge of the behaviors of the internal structures like facial muscles and skin deformation. To obtain these features, knowledge from biomechanical modeling is required. In our group, we developed recently numerical face models to understand the muscle contraction and coordination mechanism [2, 3]. The objective of this project is to translate this knowledge into an autonomous detection system dedicated for security purpose.

In addition, to deal with temporal nature of the biomechanical facial features in the detection and recognition task, a robust and accurate learning algorithm need to be developed and deployed. We developed recently a deep learning algorithm coupled with a transfer learning strategy for predicting biomechanical features [4]. This specific algorithm will be adopted to detect and recognize the face and behaviors of the involved people in this project.

This project will lead to an operational autonomous detection and recognition system for public security purpose. Important problems related to the privacy issue and user acceptability will be also studied in this project.

To achieve the objective, this 3-year PhD project is breakdown into the following tasks:
- Task 1: Data acquisition system with visual sensors (e.g. camera and/or Kinect sensor) [M1 → M6]
- Task 2: 3D subject specific face model generation with texture [M1 → M6]
- Task 3: Feature recognition and extraction [M6 → M12]
- Task 4: Deep learning model development and implementation for face and behavior detection and recognition [M12 → M24]
- Task 5: Database construction and performance evaluation [M12 → M30]
- Task 6: System deployment in testing environment and final evaluation [M30 → M36]
References:

Key words
Face behavior detection, face behavior recognition, 3D biomechanial face feature, artificial intelligence, deep learning, public security.

Requirements
Master student in the following fields: Computer engineering, Computational Biomechanics/Mechanics.
The candidate needs have the following experiences:
- 3D geometric and physical modeling, computer vision
- Knowledge/expertise with machine learning will be a plus
- Advanced programming experiences in Visual C#/C++

Starting time
01/09/2019

Location
Compiègne, UMR CNRS 7338 BMBI

Funding/Cofunding or/and partnerships:
- Région Hauts de France (cf dossier)
- Labex
- Ecole doctorale
- Partenariat industriel
- Autre (préciser)
### Part 2: Job description

<table>
<thead>
<tr>
<th>Duration</th>
<th>36 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional missions available</td>
<td></td>
</tr>
<tr>
<td>Research laboratory</td>
<td>UTC UMR 7338 Biomechanics and Bioengineering (BMBI)</td>
</tr>
<tr>
<td>Material resources</td>
<td>Working computer and intensive computing platform Pilcam2 UTC</td>
</tr>
<tr>
<td>Human resources</td>
<td>40 EC, 10 BIATSS/ITA, 40 PhD students, 10 post-docs</td>
</tr>
<tr>
<td>Financial resources</td>
<td></td>
</tr>
</tbody>
</table>
| Working conditions | Weekly meeting with supervisor  
Working schedule according to BMBI rules. |
| Research project | |
| National collaborations | |
| International collaborations | |
| International cosupervision (cotutelle) | Non |
| Contact | **Tien Tuan DAO, Ph.D.**  
Phone: 33 3 44 23 43 34  
E-mail: tien-tuan.dao@utc.fr  
Personal Web: [http://www.utc.fr/~daotient/](http://www.utc.fr/~daotient/)  
[http://publicationslist.org/daotientuan](http://publicationslist.org/daotientuan)  
Université de Technologie de Compiègne (U.T.C), Biomécanique et Bioingénierie UMR CNRS 7338, BP 20529 - 60205 Compiègne – France |
| Documents required to apply: | The closing date for the application is no later than 09 Avril 2019.  
Send to tien-tuan.dao@utc.fr  
- Curriculum vitae  
- Master academic transcript  
- Motivation letter  
- Recommendation letter(s). |

*Please contact first the thesis supervisor* before applying online on [https://webapplis.utc.fr/admissions/doctorants/accueil.jsf](https://webapplis.utc.fr/admissions/doctorants/accueil.jsf)*