Automatic classification of industrial gestures, taking into account their physical, cognitive and psycho-sociological dimensions.

SUPERVISORS
Aurélie Landry LIG, UGA & Andrea Cherubini, LIRMM UM.

INSTITUTION
LIG, Laboratoire d'Informatique de Grenoble

MOTIVATIONS AND GENERAL OBJECTIVES
The proposed internship is part of the ANR HERCULES research project, which aims at optimizing the robotic assistance provided to operators, based on new grids for identifying the risks of musculoskeletal disorders (MSD), i.e. grids based on biomechanical constraints, enriched with measures of the cognitive load and psycho-social load of gestures. To carry out a task, the human operator mobilizes his joints and maintains his posture with the aim of achieving a certain level of quality. The criteria for this quality ("well-done work" criteria) are based on both cognitive commitment and on occupational criteria, referred to as "psycho-social loads". To effectively prevent MSDs, and to design robotic assistance systems with this objective in mind, we need to expand our vision of a protective "good gesture" towards a protective "sensitive gesture", specific to each operator when carrying out a task.

To provide appropriate assistance, the robot must be controlled on the basis of a prior classification of gestures. This classification could be based on neural network training. The aim of the internship is to begin this initial training phase on an industrial task involving the dismantling and reassembling of a tidal turbine, within the INPG's Operation Management platform.

PROPOSED WORK PLAN

After understanding the challenges of the project, the trainee will :
- Prepare a state-of-the-art report
- Break down tidal turbine dismantling and/or reassembling activities (to be decided) into gestures,
- Carry out an in situ biomechanical assessment of tidal turbine dismantling and reassembling gestures, and video capture,
- Assess in situ operators' cognitive and psychosocial workload, using interviews and ratings for each gesture,
- Train a neural network for automatic classification of industrial gestures,
- Propose a robotic assistance score based on the biomechanical load weighted by cognitive and psychosocial values for each gesture.

LIST OF REFERENCES

Kumar Singh A., Adjel M., Bonnet V., Passama R., **Cherubini A.** (2022), A framework for recognizing industrial actions via joint angles, Int. Conf. IEEE Humanoids. https://hal.science/hal-03925161/file/singh.pdf

Cippelletti, E., Azouaghe, S., Pellier, D., **Landry, A.** (2023) Evaluation of MSD before the implantation of a cobot: taking into account the psychosocial aspects and the subjective experience of employees, Industrial Relations-Relations Industrielles, 78(1) https://doi.org/10.7202/1101311ar

DESIRED EXPERIENCES OR QUALIFICATIONS OF THE STUDENT

- Master 2 student in computer science or cognitive science
- Proficiency in Python
- Knowledge of neural networks and other classification methods (Support Vector Machines, etc.)
- Knowledge of mixed methods for collecting quantitative and qualitative data
- Basic knowledge in ergonomics
- Interest in human sciences, particularly occupational psychology and occupational sociology
- Interest in robotics

CONDITIONS

- 5-month on site internship in Grenoble, within the LIG, the Operation Management platform for carrying out field analyses is located within the INPG in Grenoble. https://g-scop.grenoble-inp.fr/fr/equipements/operations-management
- Internship gratification at the current legal rate
- The internship starts in February 2024

APPLICATION
Send a CV and cover letter, together with any other relevant documents, to Aurélie Landry aurelie.landry@univ-grenoble-alpes.fr and Andrea Cherubini cherubini@lirmm.fr
for December 7, and we will arrange a video exchange.