VRIJE UNIVERSITEIT BRUSSEL

The faculty of Engineering of the Vrije Universiteit Brussel invites you to attend the public defense leading to the degree of

DOCTOR OF ENGINEERING SCIENCES

of **Atieh Merikh Nejadasl**

The public defense will take place on **Tuesday 27th February 2024 at 9:00 am** in room **Q.B** (Building Q, VUB Main Campus)

To join the digital defense, please click here
Meeting ID: 382 239 561 721
Passcode: 4F5Hv6

ENHANCING ERGONOMICS THROUGH AUTONOMY-DRIVEN ADVANCEMENTS

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Abstract of the PhD research

Incorporating ergonomics into human-robot collaboration within industrial settings is an imperative driven by multiple compelling reasons. Firstly, it prioritizes the well-being and health of the industrial workforce, mitigating the risk of musculoskeletal disorders and ensuring a healthier and more satisfied workforce. Secondly, it addresses the challenges posed by repetitive and physically demanding tasks in industrial processes, reducing worker fatigue, and enhancing productivity. The central objective of this Ph.D. thesis is to seamlessly integrate ergonomic considerations into the planning and strategic framework governing collaborative robot motions. This research aims to bridge the gap between efficiency-focused robotics and the critical domain of human well-being by infusing ergonomic concerns into the decision-making processes of collaborative robots. Achieving this integration involves tackling complex challenges, including ensuring human worker safety through advanced sensing and real-time decision-making, accommodating diverse workforce needs, and promoting effective communication. Overcoming these hurdles is crucial for harnessing the full potential of collaborative robots while safeguarding the well-being of human workers. Various autonomy-driven approaches, such as real-time monitoring systems like motion capture technology and sensors, are utilized to continuously assess workers' postures and movements, identifying ergonomic issues and potential risks. Heuristic posture correction algorithms provide dynamic feedback and guidance to enhance safety and ergonomics, preventing musculoskeletal disorders, and improving overall well-being while optimizing work performance. The integration of machine learning and deep neural networks further enhances real-time monitoring and posture correction systems, contributing to improved ergonomics in industrial settings. These algorithms, trained on ergonomic assessment methods and diverse body movements, facilitate continuous evaluation and optimization of worker postures by collaborative robots. Additionally, leveraging imitation learning from skilled human workers enhances ergonomics in repetitive industrial tasks, enabling robots to replicate movements, enhance task accuracy, and reduce the risk of musculoskeletal disorders among human workers.