

Jumeaux digitaux et robotiques, comment la technologie peut améliorer le processus de réadaptation

Guillaume Durandau



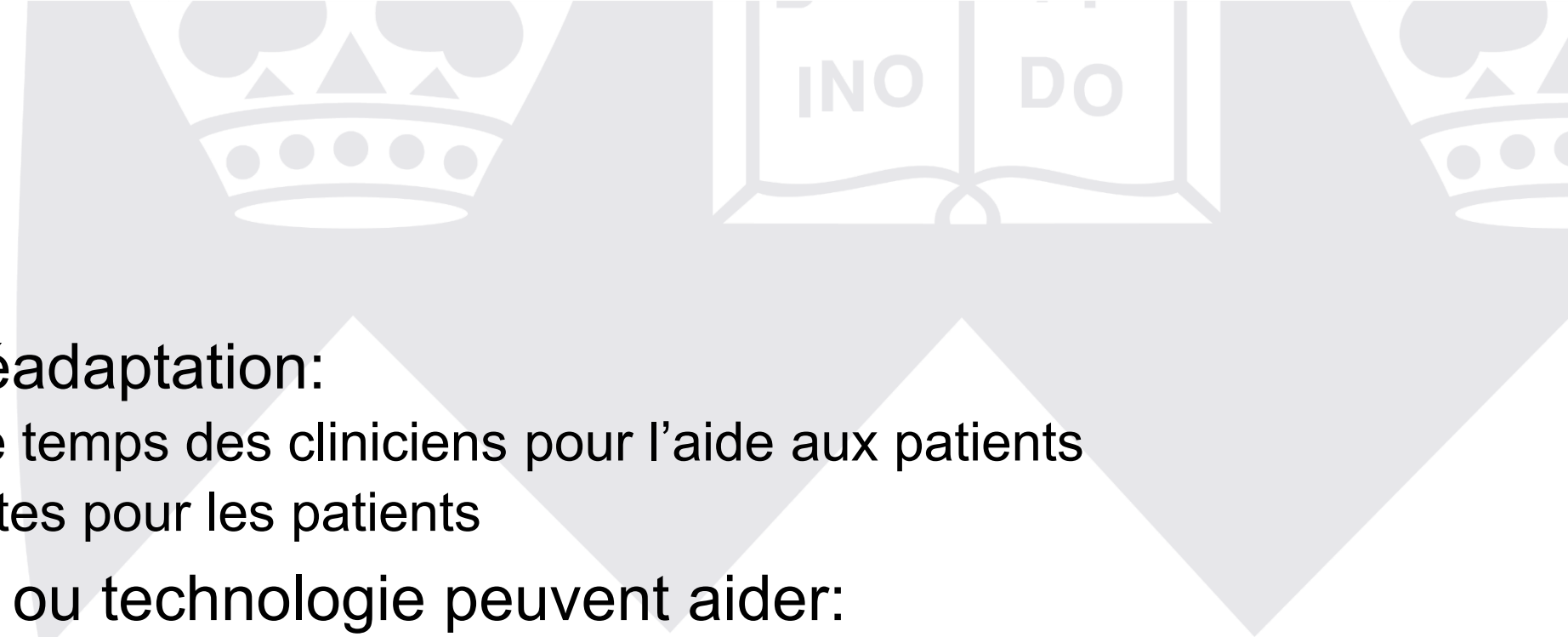
McGill



NeuroC Lab

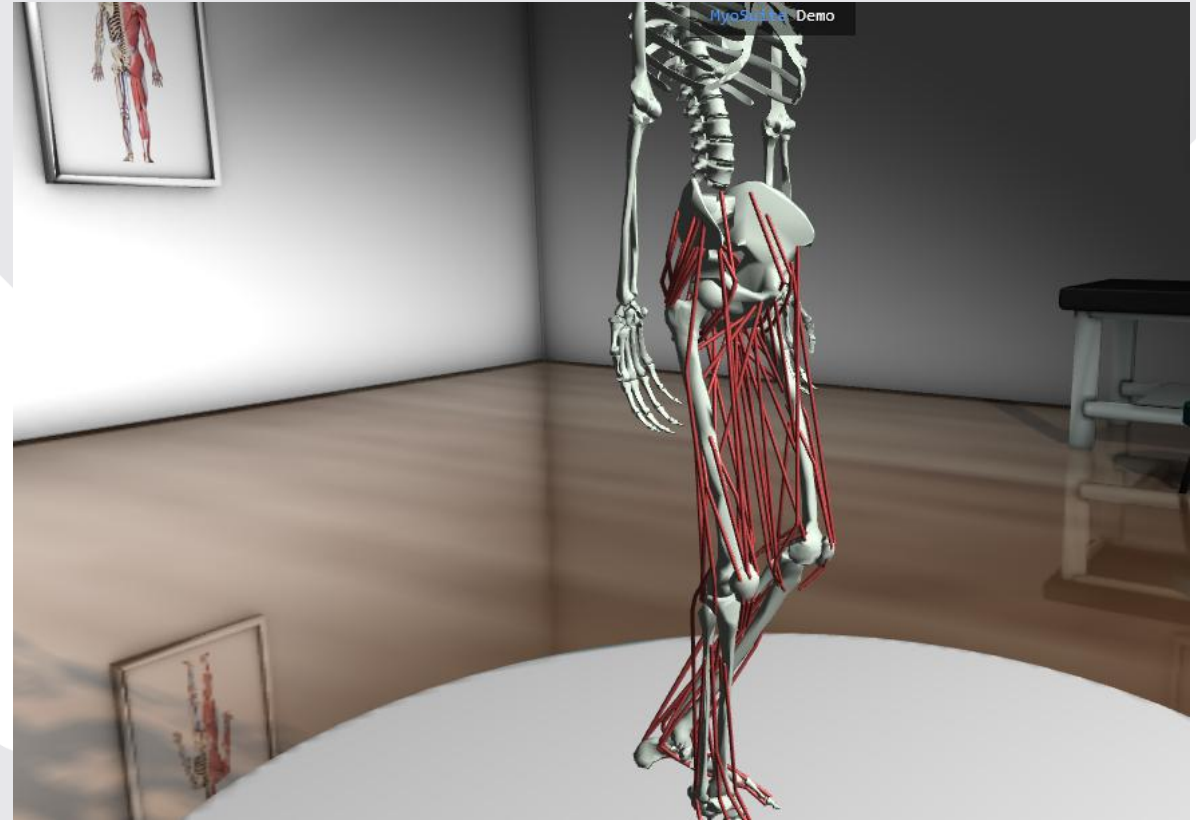
Motivation

- Hausse de l'espérance de vie
- Hausse du nombre de patients avec des besoins de réadaptation
- Hausse du nombre de cliniciens?
- Hausse du financement?

- 
- Future de la réadaptation:
 - Concentrer le temps des cliniciens pour l'aide aux patients
 - Moins de visites pour les patients
 - Trois avenues où technologie peuvent aider:
 - Évaluation du patient
 - Aide à la décision clinique
 - Intervention
- 

Modèle NMS

<https://tinyurl.com/MyoSim>



Intervention

Exosquelette:

- Réduit l'intervention humaine
- Augmente le temps d'entraînement
- Réadaptation a la maison



Lokomat

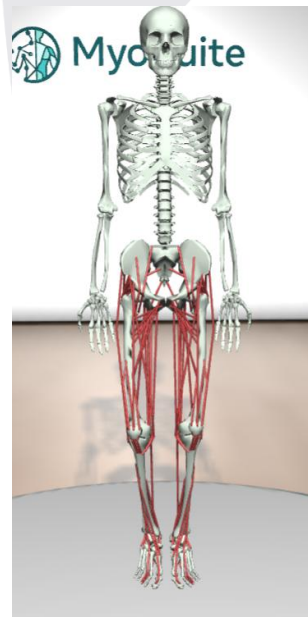


Rewalk



Biomotum

Comment informer l'exosquelette a propos du patient?



Modèle information





A person is standing in a laboratory, wearing a black and red bi-lateral ankle exoskeleton. They are holding a yellow balloon in their right hand. The background shows a laboratory with various equipment, including a desk with multiple computer monitors, a whiteboard, and a banner that reads "ottobock. xsens". The floor has blue and white markings. A yellow pole with a balloon at the bottom is visible on the right side of the frame.

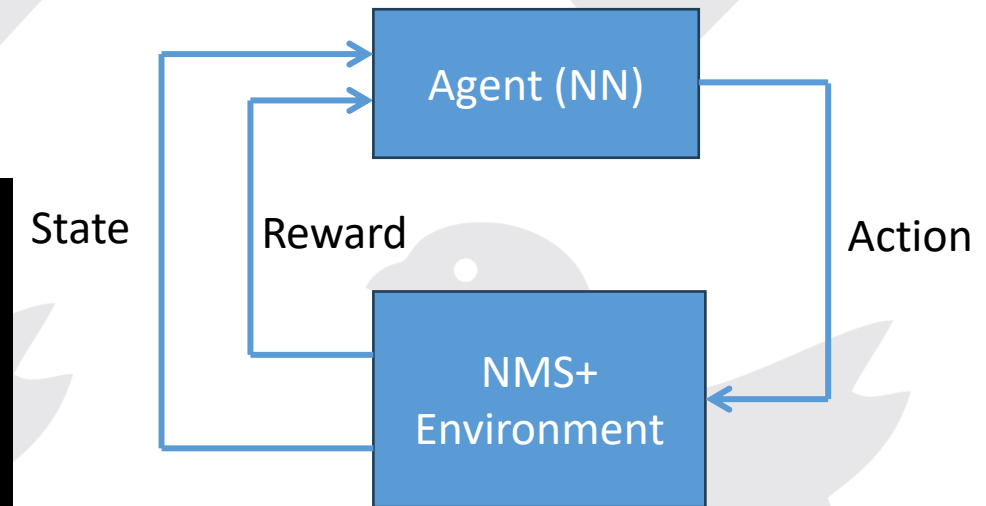
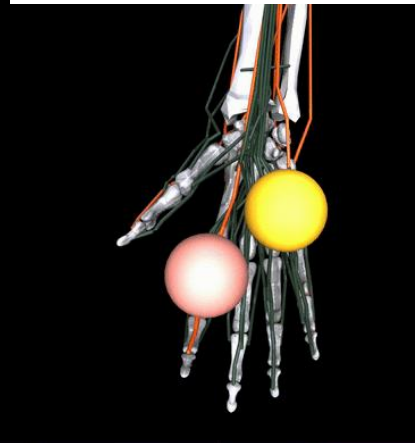
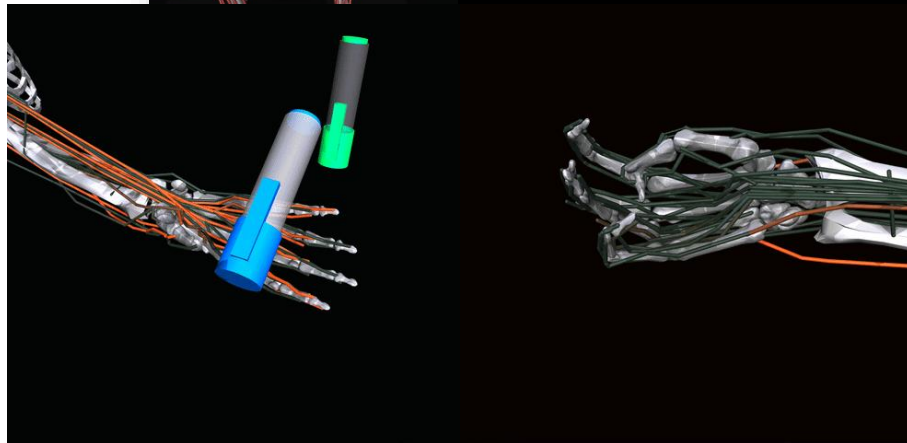
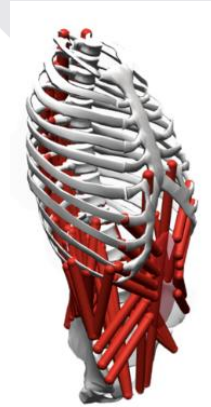
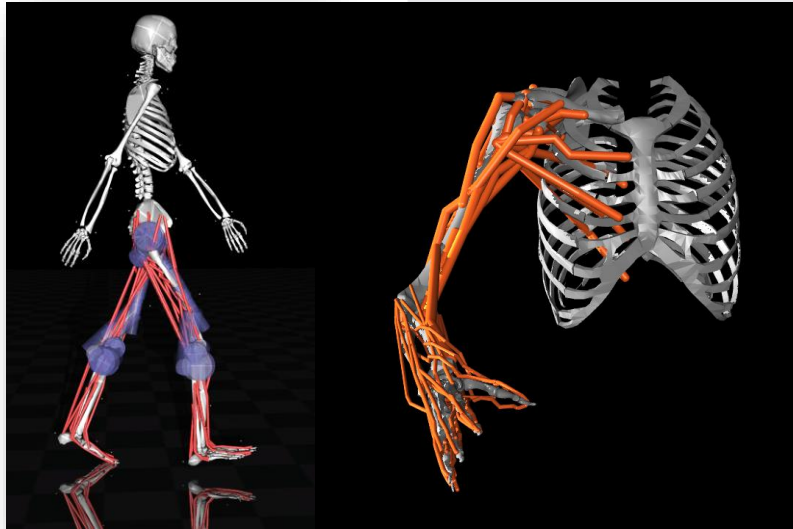
Neuromechanical model-based control of bi-lateral ankle exoskeletons: biological joint torque and electromyogram reduction across walking conditions



Aide a la décision clinique

Peut-on prédire les effets d'une intervention et guider la décision clinique?

Simulation predictive

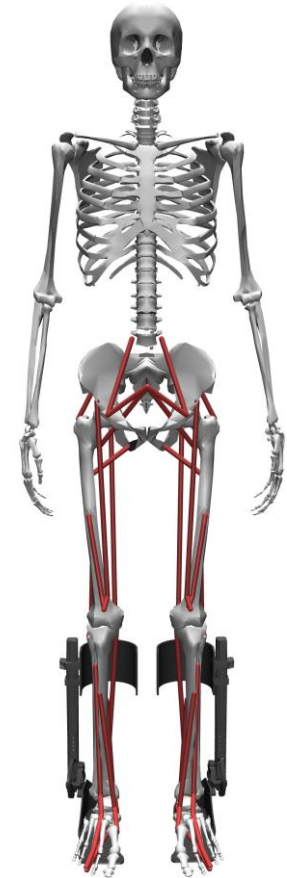
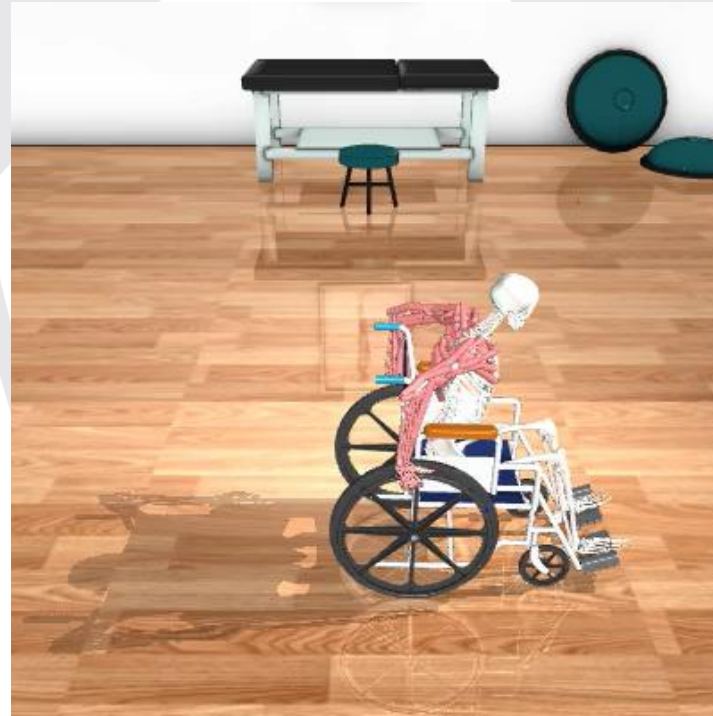
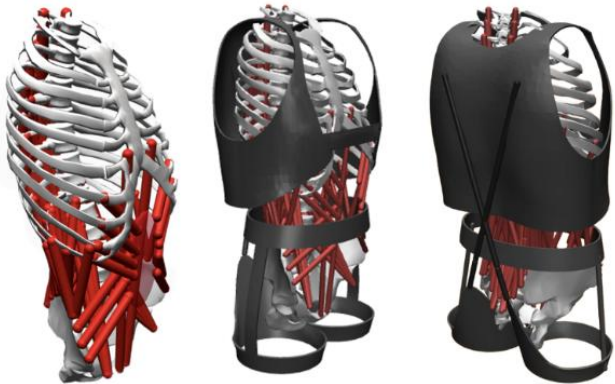


Simulation d'intervention robotique



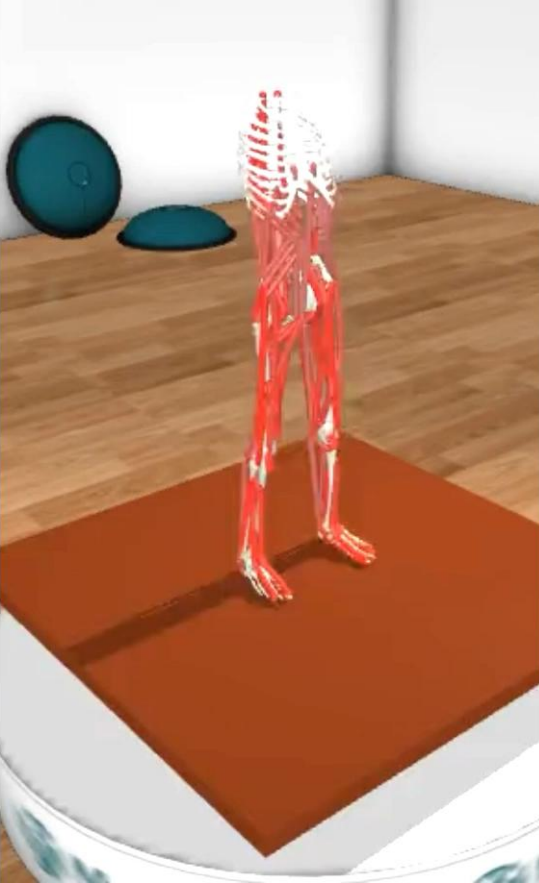
Seungmoon Song
Northeastern
University

- Prévoir les besoins en réadaptation et trouver l'intervention robotique la plus optimal



Simulation de la perte d'équilibre des personnes senior

Healthy



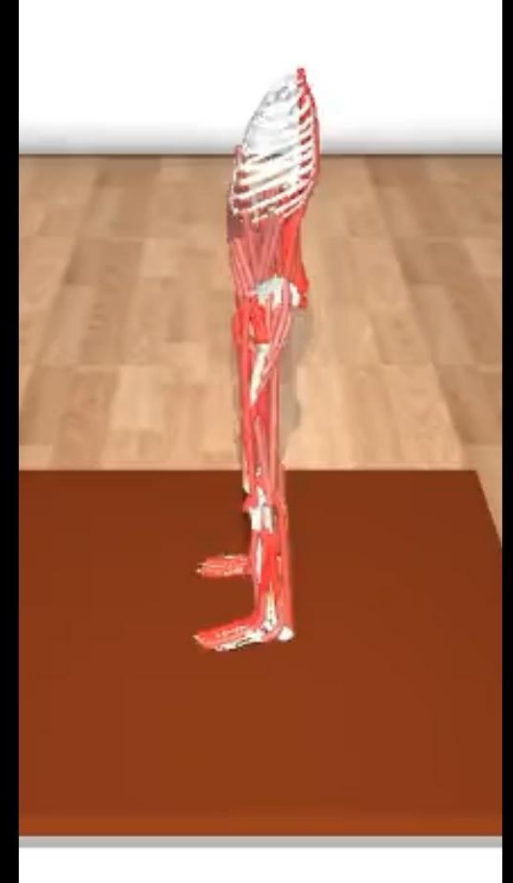
80%



60%



40%



McGill

Wang, H., Kovecses, J. and Durandau, G., 2025. Reinforcement Learning Identifies Age-Related Balance Strategy Shifts. *IEEE TNSRE*.



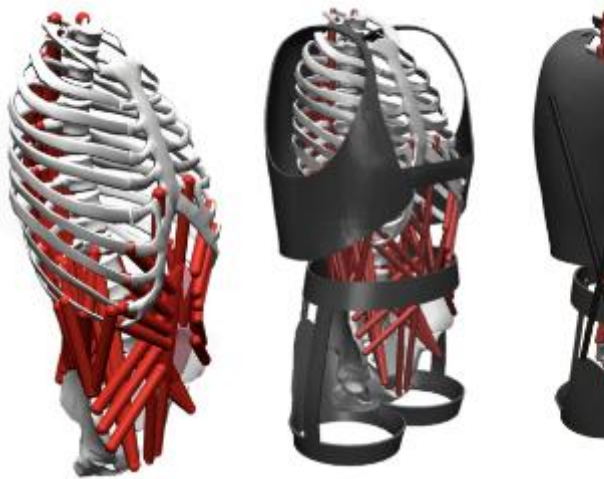
NeuroC Lab

Exosquelette de dos pour l'assistance au déplacement de patients



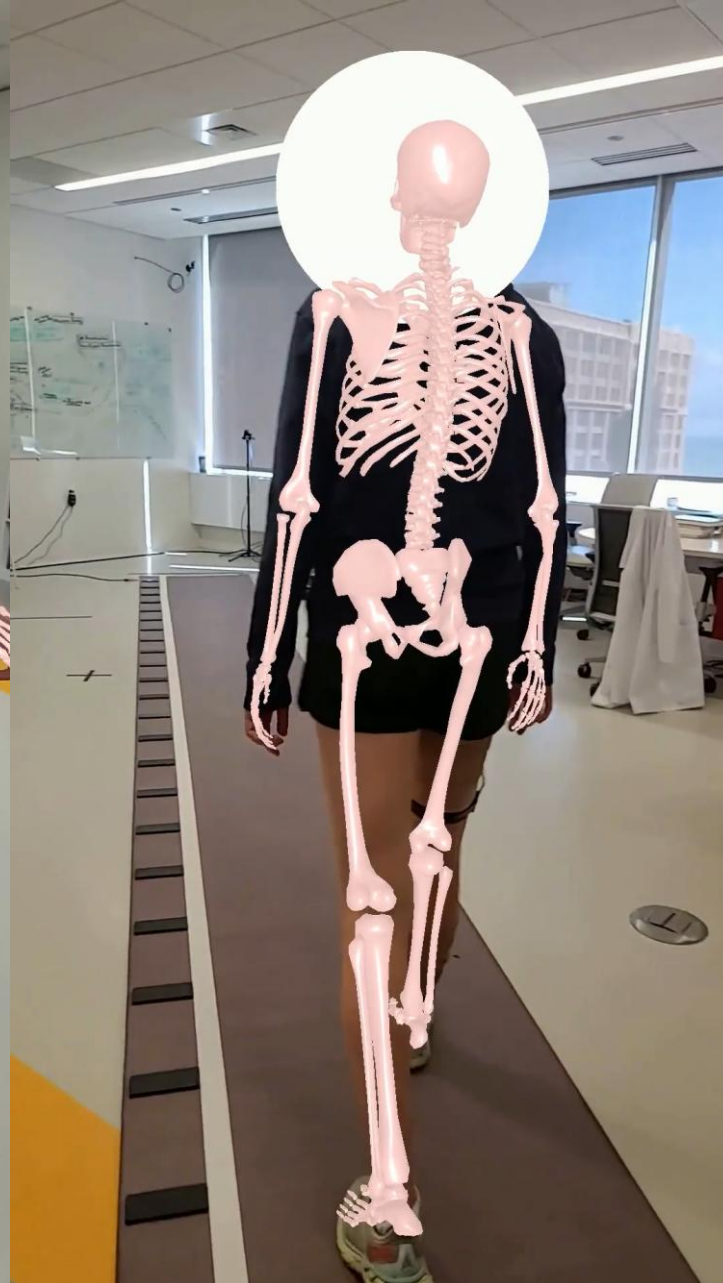
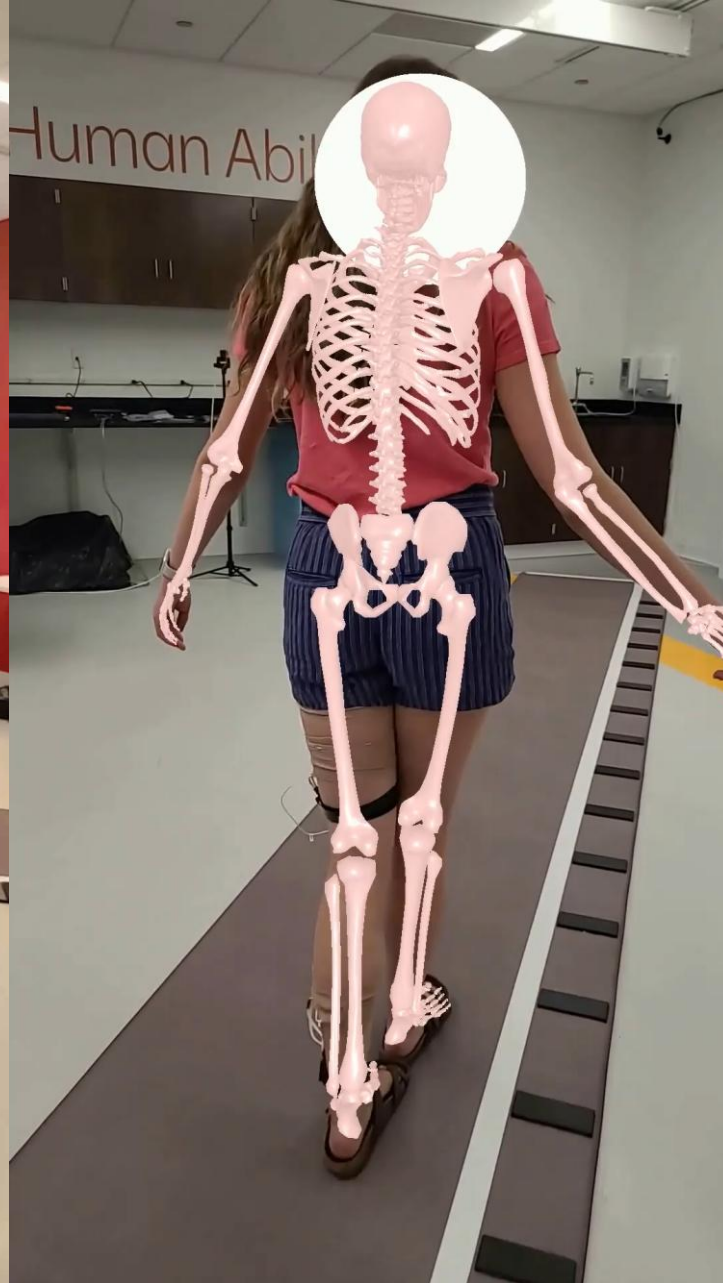
Etienne Goubault
IRSST

- Trouver le bon exosquelette de dos pour la bonne tâches/personnes



Évaluation du patient

Évaluation rapide, économique et parlante pour les cliniciens



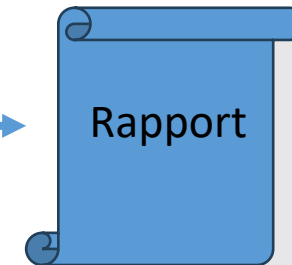
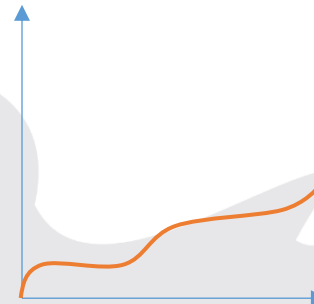
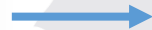
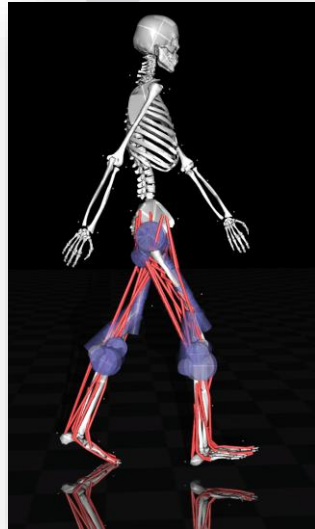
James Cotton,
Shirley Ryan
Ability lab

Capture de mouvement sans marker



Joyce Fung
McGill

- Évaluer le patient de manière consistant
- Réduire le temps d'évaluation
- Évaluation a la maison



Questions?

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NeuRoC Lab