ISADORA

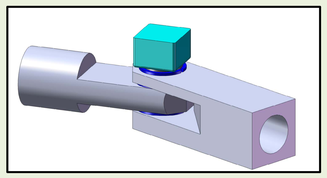
The Robot That Learns to Dance

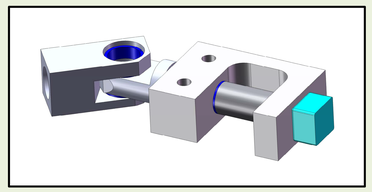
Kenshi Kawguchi, **Dave Mika**, **Sebastian Peleato**, **Eugene Peng**, **Alex Thomson**

Modelled after the human upper body, Isadora is a robot that learns to dance. While they both listen to music, a human teacher demonstrates how to dance using a miniature replica of the robot. Based on these lessons, Isadora then provides her own interpretation of any live music.

Replica Robot

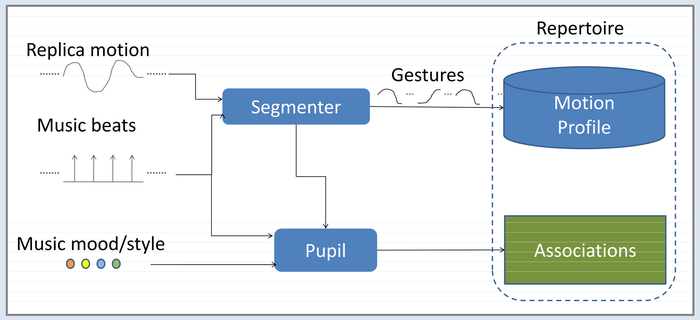
- Small unpowered version of Isadora
- Used to teach dance motions
- Optical encoders sense joint position





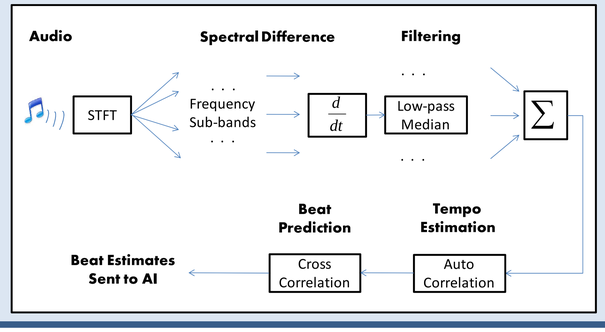
Learning Artificial Intelligence

- Processes stream of music information and replica positions
- Verifies that moves satisfy kinematic constraints
- Stores processed moves with appropriate metadata in the repertoire



Music Analysis

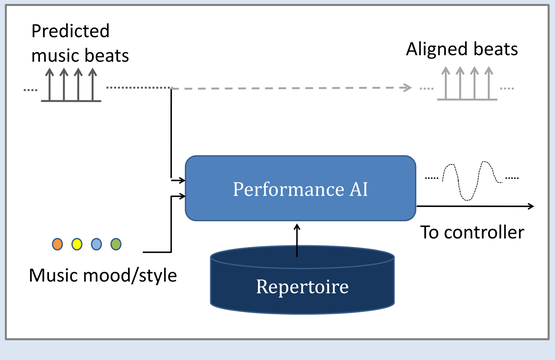
- Real-time, causal beat detection and prediction using a spectral difference algorithm
- Adapts quickly to changes in music
- Characterizes the music using mood parameters (ie: tempo)



Repertoire

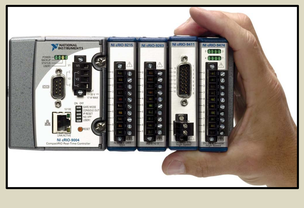
Performance Artificial Intelligence

- Chooses gesture sequences from the repertoire based on current music mood
- Repeats a sequence of gestures until the music changes or the robot gets bored
- Creates blending gestures to transition between sequences



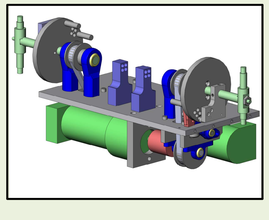
Real-Time Control

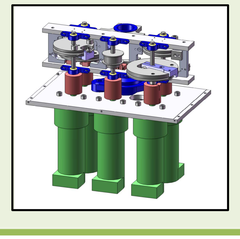
- Seven synchronized axes of motion control
- Cubic spline trajectory interpolation
- Distributed over two CompactRIO controllers
- PID control provides good trajectory tracking



Robot

- Cable and belt driven to reduce moving mass
- Motors selected using SolidWorks and CosmosMOTION
- Spherical bearings and flexible couplings accommodate student manufacturing tolerances





NATIONAL INSTRUMENTS

Thanks to National Instruments, Igus, Professor Jan Huissoon, Sheldon Brown, Jamieson Brettle, Rodger Schorr, Nipun Mathur, Devin Shelgren, and Mechanical and Mechatronics Engineering