Tests for Prospective HumanAI GSoC 2024 Applicants:

# AI-Enabled Choreography

## Overview

Below are the tests we will use to evaluate prospective GSoC contributors for the AI-Enabled Choreography project with HumanAI. We encourage you to submit your solutions at least 1 week before you aim to submit your GSoC Proposal Submission so that you have enough time to write the proposal.

## Timeline

- **Tests posted:** Feb 26, 2024
- **GSoC contributor application period begins:** March 18 6:00 PM UTC
- **GSoC contributor application period ends:** April 02 6:00 PM UTC

## Submission Guidelines

Please send us your CV and a link to all your completed work (including GitHub repository, Jupyter notebook(s) + PDF of Jupyter notebook(s) with output) to human-ai@cern.ch with "Code Submission: AI Choreo" in the subject line.

### Part 1: Visualize the data

Some motion capture data is located here. The files are in .npy format, with shape (# joints, # timesteps, # dimensions). "Joints" refer to points on the body captured by the motion capture system, which may or may not correspond exactly with true joints on the body. "Timesteps" refers to each frame of the motion capture data at a specific point in time. "Dimensions" refers to the usual (x,y,z) framework. Each file corresponds to a different motion capture session from the same dancer.

Please construct a 3D plotting function in a library of your choice that allows you to visualize dance sequences in the data for sequences of length *t* timesteps. We have some basic plotting code that you are welcome to use as a starting point. The joints need not be connected in this visualization, but you should at least be able to see the dancer standing upright and moving as a cloud of points.

**Part 2: Train a generative model**

Use this motion capture data to train a neural network to generate short fixed-length dance phrases (a good goal would be between 2 and 5 seconds, or 50 - 128 timesteps, at a time). We recommend a Variational Autoencoder (VAE) structure with LSTM layers operating on a fixed size input vector, but you can use any architecture of your choice, including GNN-based models, Transformers, etc. Some example models may be used as inspiration: a VAE with LSTM layers and a GNN-based VAE. Explain the reasoning behind your choice.

Use your plotting code to compare an input dance sequence from a holdout test set with its corresponding decoded sequence.

Then, use your model to generate a new dance sequence, either randomly or conditioned on a real sequence in the test set, and visualize it with your plotting code.

*Note:* If you are interested in this project but the timeseries prediction is proving too complex in this short timeframe, you may also complete this part with a generative model trained on static images of dancer poses. You might also choose to augment and/or preprocess the data to make the task easier for the model to solve.

**Part 3: Why this project?**

Please write a brief (300 words or less) description of your interest in this project. Let us know if you have particular ideas for how you would approach modeling duets with AI. Please also describe any previous experience or interest in art as well as any thoughts or feelings about AI in art.