**Encoder Decoder Manual**

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**ay\_main\_function**: This function calls both the encoder and decoder functions. This wrapper function was written to show how different parameters can be set to the encoder and decoder functions.

**ay\_run\_encoder**: Encoder function, which builds the training and testing data set for the decoder function.

**ay\_run\_decoder**: Decoder function, which runs different decoder models and saves the decoding result.

**How to interpret performance files:**

Performance files keep the decoding result per each time step, and they have different entries depending on which decoding method is being called.

Exact solution: Each line of the performance file keeps the following information.

-Timestep : 2,3,4,5,…

-Number of Spikes: 0,1,…- mostly 0 and 1

-Sample time: Sec

-Rat Position in X: mm

-Rat Position in Y: mm

-In 95% HPD Coverage Area: 0 or 1

-Prediction distance error: mm, using mean of posterior

-Prediction distance error: mm, using mode of posterior

-Area of 95% HPD: mm^2

-Prediction of rat position in X: mm, mean of posterior

-Prediction of rat position in Y: mm, mean of posterior

-Processing time: Sec

Gaussian/GMM 2D solution: This is very similar to the exact, except it keeps number of mixture per each time steps. Each line has the following information.

-Timestep : 2,3,4,5,…

-Number of Spikes: 0,1,…- mostly 0 and 1

-Sample time: Sec

-Rat Position in X: mm

-Rat Position in Y: mm

-In 95% HPD Coverage Area: 0 or 1

-Prediction distance error: mm, using mean of posterior

-Prediction distance error: mm, using mode of posterior

-Number of Mixtures: 1,2,3,…

-Area of 95% HPD: mm^2

-Prediction of rat position in X: mm, mean of posterior

-Prediction of rat position in Y: mm, mean of posterior

-Processing time: Sec

Gaussian/GMM 4D solution: This is very similar to the Gaussian/GMM 2D, except it keeps extra information about new dimensions. Each line has the following information.

-Timestep : 2,3,4,5,…

-Number of Spikes: 0,1,…- mostly 0 and 1

-Sample time: Sec

-Rat Position in X: mm

-Rat Position in X: mm

-Rat Velocity in X axis: mm/s

-Rat Velocity in Y axis: mm/s

-In 95% HPD Coverage Area: 0 or 1

-Prediction distance error: -, using mean of posterior (4D)

-Prediction distance error: -, using mode of posterior (4D)

-Number of Mixtures: 1,2,3,…

-Prediction distance error: mm, using mean of posterior (2D)

-Area of 95% HPD: mm^2

-Prediction of rat position in X: mm, mean of posterior

-Prediction of rat position in Y: mm, mean of posterior

-Processing time: Sec

Particle Filter solution: For the particle filter, we keep the following information per each time step.

-Timestep : 2,3,4,5,…

-Number of Spikes: 0,1,…- mostly 0 and 1

-Sample time: Sec

-Rat Position in X: mm

-Rat Position in X: mm

-Prediction distance error: -, using mean of posterior (4D)

-Prediction of rat position in X: mm, mean of posterior

-Prediction of rat position in Y: mm, mean of posterior

-Processing time: Sec

**Which Folder Keeps What?**

**rat\_cell\_data:** This folder keeps all experimental data

**encoder\_files:** This folder might be used to keep encoder files

**decoder\_performance:** This folder might be used to keep decoder performance files – the one which is described in the previous section

**decoder\_per\_timestep:** This folder might be used to keep the decoding result per each time step. This includes particles for the particle filter solution, posterior distribution using the exact solution, and GMM/Gaussian models using proposed solution.