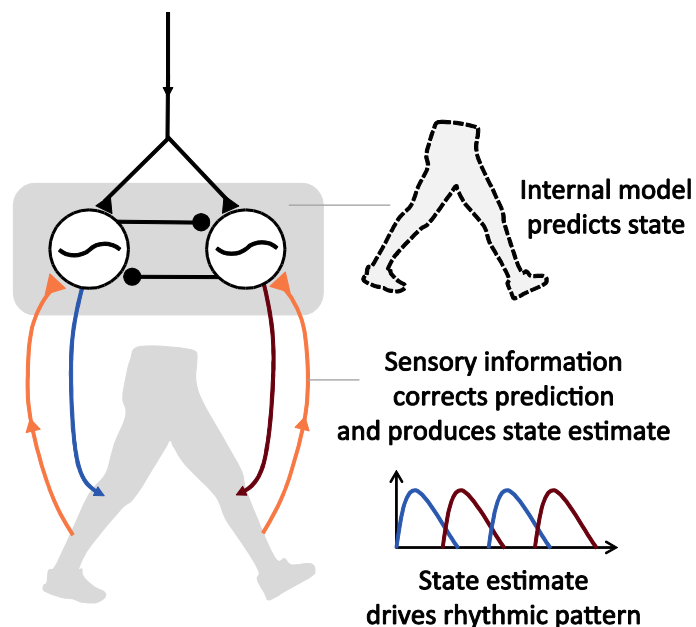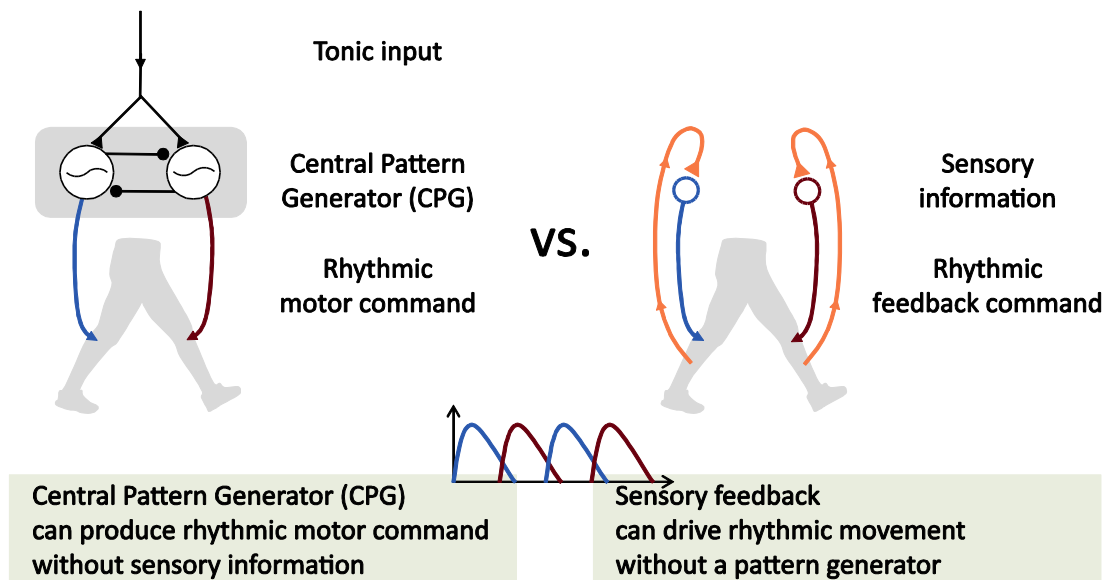# An adaptive neural network learns to be a state estimator and central pattern generator (CPG)

Hansol Ryu[1,2], Art D. Kuo[1]
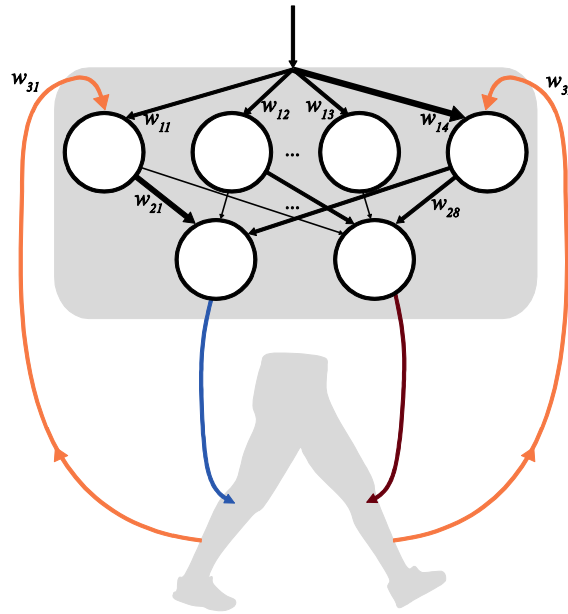
[1]University of Calgary, [2]Korea Advanced Institute of Science and Technology

Tonic input

Central Pattern
Generator (CPG)

Rhythmic
motor command

vs.

Sensory
information

Rhythmic
feedback command

Central Pattern Generator (CPG)
can produce rhythmic motor command
without sensory information

Sensory feedback
can drive rhythmic movement
without a pattern generator

Internal model
predicts state

Sensory information
corrects prediction
and produces state estimate
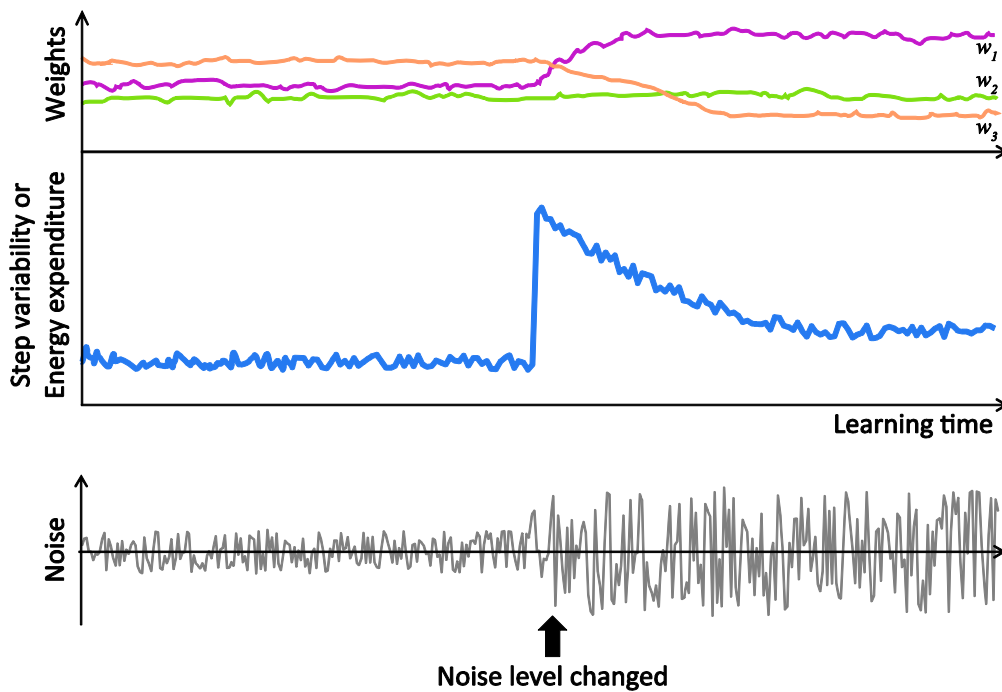
State estimate
drives rhythmic pattern

We previously proposed state estimator interpretation of CPG,
with relative gains for sensory feedback and
internal rhythm determined by noise from environment and sensors[1].

[1] Kuo, A. D. *Motor control*, **6.2**: 129-145, 2002

It's still not known whether and how a neural system can perform state estimation and rhythmic pattern generation.

Goal: Train a neural network to perform state estimation for rhythmic movement generatrion

We will also show how CPG adapts to changed conditions