

ARCHITECTURE, SYSTEM, AND METHOD FOR SIMULATING DYNAMICS BETWEEN EMOTIONAL STATES OR BEHAVIOR FOR A MAMMAL MODEL AND ARTIFICIAL NERVOUS SYSTEM

Technical Field

[0001] Various embodiments described herein relate to apparatus and methods for simulating behavior and emotion state(s) for a mammal model and an artificial nervous system.

Background Information

[0002] It may be desirable to simulate dynamics between behavior and emotional states for a mammal model and an artificial nervous system. Embodiments herein provide architecture, systems, and methods for same.

Summary

[0002a] In a first aspect, the present disclosure provides a computer implemented emotion system of an artificial nervous system, for animating a virtual object, digital entity, or robot, comprising: a plurality of states, each state of the plurality of states representing an emotional state (ES) of the artificial nervous system; a module for processing a plurality of inputs, wherein the module determines modality- independent activity patterns of the inputs over time, the processed plurality of inputs applied to the plurality of states, wherein a respective current level of one or more of the plurality states is affected by the application of the plurality of inputs and wherein the respective current level of one or more of the plurality states represents one of the active emotional states of the artificial nervous system.

[0002b] In a second aspect, the present disclosure provides a computer implemented emotion system of an artificial nervous system, for animating a virtual object, digital entity, or robot, comprising: a plurality of states, each state of the plurality of states representing an emotional state (ES) of the artificial nervous system; a predictor module computing a prediction error based at least in part on received sensory input associated with an occurrence of a type of stimuli, the sensory input corresponding to a neural input in a plurality of received inputs, the prediction error comprising a stimulus input causing a change in a current level of at least one active ES of the artificial nervous system.

Brief Description of the Drawings

[0003] FIG. 1 is a simplified diagram of dynamics or pathology between emotional states or behaviors of an artificial nervous system according to various embodiments.

[0004] FIG. 2A is a simplified diagram of a module simulating the dynamics or pathology between two emotional states or behaviors according to various embodiments.

[0005] FIG. 2B is a simplified diagram of a module simulating the dynamics or pathology between three emotional states or behaviors according to various embodiments.

[0006] FIG. 2C is a simplified diagram of a module simulating the dynamics or pathology between eight emotional states or behaviors according to various embodiments.

[0007] FIG. 3A is a diagram of a multiple input data processing module that may generate signals or weights for module(s) shown in FIGS. 2A-2C according to various embodiments.

[0008] FIG. 3B is a diagram of a plurality of multiple input data processing modules where each module may generate signals or weights for a module shown in FIGS. 2A-2C according to various embodiments.

[0009] FIG. 4A is a simplified block diagram of a data processing module network that may generate signals or weights for module(s) shown in FIGS. 2A-2C and FIGS. 4B-4C according to various embodiments according to various embodiments.

[0010] FIG. 4B is a diagram of a dynamical system for modeling emotions according to various embodiments.

[0011] FIG. 4C is diagram of a subcortical circuit according to various embodiments.

Claims

1. A computer implemented emotion system of an artificial nervous system, for animating a virtual object, digital entity, or robot, comprising: a plurality of states, each state of the plurality of states representing an emotional state (ES) of the artificial nervous system; a module for processing a plurality of inputs, wherein the module determines modality-independent activity patterns of the inputs over time, the processed plurality of inputs applied to the plurality of states, wherein a respective current level of one or more of the plurality states is affected by the application of the plurality of inputs and wherein the respective current level of one or more of the plurality states represents one of the active emotional states of the artificial nervous system.
2. The emotion system of claim 1, wherein the ES of the artificial nervous system are competing ES.
3. The emotion system of claim 1, wherein each of the plurality of inputs represents a neural input.
4. The emotion system of claim 3, wherein a neural input is a sensory input provided to the emotion system.
- ~~5. The emotion system of claim 4, wherein the sensory input includes at least one of: a visual input, an auditory input and a touch input.~~
- ~~6. The emotion system of claim 5, wherein at least one respective sensory input is generated from a User via an input module.~~
- ~~7. The emotion system of claim 6, wherein at least one respective sensory input is computer generated.~~
- ~~8.5.~~ The emotion system of claim 1, further including an output module that conveys one or more of respective current levels of the active emotional states of the artificial nervous system to a User in a perceptible format.
- ~~9.6.~~ The emotion system of claim ~~85~~, wherein the perceptible format is one of a visual format and an auditory format.

- ~~10.7.~~ The emotion system of claim ~~96~~, wherein the perceptible format is a visual two-dimensional representation of at least a portion of a mammal model.
- ~~11.8.~~ The emotion system of claim 1, wherein a module for processing a plurality of inputs integrates each of the plurality of inputs over time.
- ~~12.9.~~ The emotion system of claim 1, wherein a module for processing a plurality of inputs determines the rate of change of each of the plurality of inputs over time.
- ~~13.10.~~ The emotion system of claim 1, wherein a module for processing a plurality of inputs determines the rate of change of each of the plurality of inputs over time, sums all the plurality of inputs together, and sums all of the plurality of inputs determined rate of change.
- ~~14.11.~~ The emotion system of claim 1, wherein a module for processing a plurality of inputs integrates each of the plurality of inputs over time, sums all the plurality of inputs together, and sums integrations of all of the plurality of inputs.
- ~~15.12.~~ The emotion system of claim 1, including at least three states, representing three competing ES of the artificial nervous system.
- ~~16.13.~~ The emotion system of claim ~~15.12~~, wherein less time is required to change from the 2nd state to the 1st state than the time required to change from 1st state to the 2nd state.
- ~~17. The emotion system of claim 16, wherein less time is required to change from the 2nd state to the 3rd state than the time required to change from 3rd state to the 2nd state.~~
- ~~18. The emotion system of claim 17, wherein 1st state represents an anger ES, the 2nd state represents a neutral ES, and the 3rd state represents a fear ES.~~
- ~~19.14.~~ A computer implemented emotion system of an artificial nervous system, for animating a virtual object, digital entity, or robot, comprising: a plurality of states, each state of the plurality of states representing an emotional state (ES) of the artificial nervous system; a predictor module computing a prediction error based at least in part on received sensory input associated with an occurrence of a type of stimuli, the sensory input corresponding to a neural input in a plurality of received inputs, the prediction error comprising a stimulus input causing a

change in a current level of at least one active ES of the artificial nervous system.

~~20.~~15. The emotion system of claim [19](#)14, wherein the predictor module computes one or more predictions based at least in part on one or more received sensory inputs and computes one or more prediction errors based on respective predictions..

~~21.~~16. The emotion system of claim [19](#)14, wherein the stimulus input based on the prediction error corresponds to an amount of density of neural firing related to the change in the current level of at least one active ES in the artificial nervous system.

~~22.~~17. The emotion system of claim [24](#)16, wherein the artificial nervous system is configured to enter a perturbed state in response to a sustained amount of density of neural firing in response to prediction error.

~~23.~~18. The emotion system of claim [24](#)17, wherein the artificial nervous system is configured to enter a perturbed state in response to an increased amount of density of neural firing in response to prediction error.

~~24. —The emotion system of claims 22 or 23, wherein the artificial nervous system is configured to attempt one or more new solution approaches in response to the perturbed state.~~

~~25. —The emotion system of claims 22 or 23, wherein the perturbed state is at least one of: $\div$ being startled, fear, interest and anger.~~

~~26. —The emotion system of claim 24, wherein the artificial nervous system is configured to, in response to a decrease in the prediction error resulting from at least one of the new solution approaches, exit the perturbed state.~~

~~27.~~19. The emotion system of claim 1 or claim [19](#)14 wherein one or more ES are represented by a network state of the artificial nervous system.

~~28.~~20. The emotion system of claim 1 or claim [19](#)14 wherein one or more ES are represented by a dynamic pattern of network activity of the artificial nervous system.