

Real-time Experienced-based Predictive Simulator (REPS) vs Deep Learning

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REPS vs Deep Learning

Feature	Deep Learning/ Neural Nets	REPS	Notes
Explainable	No	Yes	Identify experiences that support the results as well as the key predicting indicators for this context.
Real-time Incremental Training	No	Yes	Each new experience can be added incrementally and goes hot immediately.
Real-time unlearning	No	Yes	Bad experiences can be removed from the training at any time.
Usefulness starts with Small Data	No	Yes	Predictions can start to form with as little as 20 experiences depending on the range of different experiences.
Open World	No	Yes	There is no limit to the variety of data that can be factored in at any time.
Resilient to Bad Data	No	Yes	Predictions can be made when not everything matches (e.g. wrong observations).
Resilient to missing Data	No	Yes	Predictions can be made when there is missing data (e.g. missing observations).
Unattended Digital Twin Modeling	No	Yes	Digital Twin Simulation based on Behavior-based Models derived from past experiences.
Incremental Real-time accuracy testing	No	Yes	Previously trained experiences can be unlearned and their situation tested to see if it can accurately be predicted by the remaining experiences.
Real-time identification of key combinations of triggers	No	Yes	Predictions can be run backwards where the forward prediction becomes the input and the experiences are run backwards to identify the common co-occurring facts. This is useful in root cause analysis.
Selective identification and culling of underperforming past experiences	No	Yes	Older experiences may no longer represent the current level of combined experience accuracy. These can be automatically detected and removed to improve overall accuracy and speed.

How it works: Background Definitions

- A Fact is an Object with one or more Attribute-Value Pairs (AVPs)
- A Situation is a set of Facts
- A Stimulus is a reported Preceding Situation
- A Response is a reported Succeeding Situation
- An Experience is an identified Stimulus-Response Pair
[note: may occur in time relative to other Experiences]



REPS is About Time

- Shift information from the Connectedness of things to other things → to connectedness of things in time.
- Group things “occurring” together at one time (or time frame) [note: may not be connected otherwise]
- Arrange these Groups in “Stimulus-Response Pairs” (SRPs) [usually based on observations] (Note: this is input to REPS)
- Use the available Stimulus-Response Pairs (SRPs) to discover and exploit patterns of co-occurring facts to predict behavior of the system for a given situation. (Note: this is what REPS does)



Prediction

- A Prediction is an ordered set of Situations, based on the available Experiences
- A Prediction Explanation lists the most relevant Experiences to a given Situation and how each Experience contributes to the Prediction.
- In addition, a “correlative explanation” (potentially suggestive of cause), identifies sets of commonly occurring predictive stimulus-response patterns also mapped to experiences.

Prescription

- Desired Outcome is a list of relatively weighted Outcome Dimensions
- Outcome Dimension specifies an AVP + ODRF
- Outcome Dimension Recognition Function (ODRF) specifies how the Outcome Dimension value is determined.
- A Prescription is an ordered set of changes to the given Situation that if applied, would maximize a set of desired outcomes, based on the available Experiences and given a weighted set of Outcome Dimensions.
- A Prescription Explanation lists how the effects of each ordered set of changes to the given situation, contribute to Desired Outcome (sum of weighted Outcome Dimensions).

