Title: Human-in-the-loop

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Unsupervised learning

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Bayes net

Conditional random field

Hidden Markov

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Recurrent neural network LSTM GRU ESN reservoir computing

LSTM

GRU

ESN

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U-Net

LeNet

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Neural radiance field

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List of datasets for machine-learning research List of datasets in computer vision and image processing

List of datasets in computer vision and image processing

Outline of machine learning

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Human-in-the-loop (HITL) is used in multiple contexts. It can be defined as a model requiring human interaction. [1] [2] HITL is associated with modeling and simulation (M&S;) in the live, virtual, and constructive taxonomy . HITL along with the related human- on -the-loop are also used in relation to lethal autonomous weapons . [3] Further, HITL is used in the context of machine learning . [4]

Machine learning

In machine learning, HITL is used in the sense of humans aiding the computer in making the correct decisions in building a model. [4] HITL improves machine learning over random sampling by selecting the most critical data needed to refine the model. [5]

Simulation

In simulation, HITL models may conform to human factors requirements as in the case of a mockup . In this type of simulation, a human is always part of the simulation and consequently influences the outcome in such a way that is difficult if not impossible to reproduce exactly. HITL also readily allows for the identification of problems and requirements that may not be easily identified by other means of simulation.

HITL is often referred to as interactive simulation, which is a special kind of physical simulation in which physical simulations include human operators, such as in a flight or a driving simulator .

Benefits

Human-in-the-loop allows the user to change the outcome of an event or process. The immersion effectively contributes to a positive transfer of acquired skills into the real world. This can be demonstrated by trainees utilizing flight simulators in preparation to become pilots.

HITL also allows for the acquisition of knowledge regarding how a new process may affect a particular event. Utilizing HITL allows participants to interact with realistic models and attempt to perform as they would in an actual scenario. HITL simulations bring to the surface issues that would not otherwise be apparent until after a new process has been deployed. A real-world example of HITL simulation as an evaluation tool is its usage by the Federal Aviation Administration (FAA) to allow air traffic controllers to test new automation procedures by directing the activities of simulated air traffic while monitoring the effect of the newly implemented procedures. [6]

As with most processes, there is always the possibility of human error , which can only be reproduced using HITL simulation. Although much can be done to automate systems, humans typically still need to take the information provided by a system to determine the next course of action based on their judgment and experience. Intelligent systems can only go so far in certain circumstances to automate a process; only humans in the simulation can accurately judge the final design. Tabletop simulation may be useful in the very early stages of project development for the purpose of collecting data to set broad parameters, but the important decisions require human-in-the-loop simulation. [7]

Within virtual simulation taxonomy

Virtual simulations inject HITL in a central role by exercising motor control skills (e.g. flying an airplane), decision making skills (e.g. committing fire control resources to action), or communication skills (e.g. as members of a C4I team).

Examples

Flight simulators

Driving simulators

Marine simulators

Video games

Supply chain management simulators [8]

Digital puppetry

Misconceptions

Although human-in-the-loop simulation can include a computer simulation in the form of a synthetic environment, computer simulation is not necessarily a form of human-in-the-loop simulation, and is often considered as human-out-of-the loop simulation. In this particular case, a computer model’s behavior is modified according to a set of initial parameters. The results of the model differ from the results stemming from a true human-in-the-loop simulation because the results can easily be replicated time and time again, by simply providing identical parameters.

Weapons

Three classifications of the degree of human control of autonomous weapon systems were laid out by Bonnie Docherty in a 2012 Human Rights Watch report. [3]

human-in-the-loop : a human must instigate the action of the weapon (in other words not fully autonomous)

human-on-the-loop : a human may abort an action

human-out-of-the-loop : no human action is involved

See also

Humanistic intelligence , which is intelligence that arises by having the human in the feedback loop of the computational process [9]

Reinforcement learning from human feedback

MIM-104 Patriot - Examples of a human-on-the-loop lethal autonomous weapon system posing a threat to friendly forces.

References