Extended Concept for Meaning Based Inferences - Part 2 Version 1

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Abstract

In a preceding post with the title 'Extended Concept for Meaning Based Inferences. Version 1'[1] I had continued two other posts 'CASE STUDY SIMULATION GAMES - PHASE 1: Observer-World-Framework'[2] and 'The Simulator as a Learning Artificial Actor [LAA]. Version 1'.[3] All three posts explained a truth concept embedded in a meaning concept and derived from this an extended view of the inference from a given state – a set of facts assumed to be true – to some condition Φ which shall be decided to be satisfied by the state S. But in the post from August 30, 2020 with the title 'Extended Concept for Meaning Based Inferences' I introduced an inference concept which in the light of real case studies (done by Philipp Westermeier and Athene Sorokowski) showed up to be to simple. In this text I show how this inference concept can easily be extended to include much more possibilities without changing the theory.

1 Generating Follow-up States

As described in the before mentioned posts it is assumed in this text that a *follow up state* S' of a *given state* S will be generated by either (i) *deleting* some expressions E^- of the given state S if converted to S' or (ii) by extending the state S by some new expressions E^+ for the construction of S' by*creating* new expressions, written as $S' = S - E^- \cup E^+$.

[1]See: https://www.uffmm.org/2020/08/30/extended-concept-for-meaning-based-inferences-version-1/

[2]See: https://www.uffmm.org/2020/07/16/the-observer-world-framework-part-of-case-studies-phase-1/

[3]See: https://www.uffmm.org/2020/08/23/the-simulator-as-a-learning-artificial-actor-laa-version-1/

For this to happen it is assumed in this text that there are *change rules* X where each rule has the following format: *IF*-part and *THEN*-part, written as $X \subseteq X_{if} \times X_{then}$. While an element of the then-part has always the format $X_{then} \subseteq E^{-} \times E^{+}$ an element of the if-part is a set of expressions which have to be *valid*. One can generalize this case in the following way: If we assume that the expressions of the state S are all *true* with regard to the assumed part of the world then it has to be clarified for each expression Φ in the if-part of a change rule whether this expression is *true* in the assumed state S or not. We allow that the IF-part of a change rule can contain more than one expression Φ, either as a *disjunction* written as $\Phi_1 \vee ... \vee \Phi_n$ or as a *conjunction* written as $\Phi_1 \wedge ... \wedge \Phi_n$. The disjunction is satisfied only if at least one of the expressions Φ_i is satisfied and the conjunction is satisfied when all expressions together are satisfied.

For the details of an expression Φ in the IF-part we assume the following different cases:

Actor-Free Inference Rules: For the whole IF-THEN-inference rule it is assumed that a change can happen without explicit mentioning an actor. This requires for the IF-part only expressions which can be satisfied by the set of facts in the state S and then in the THEN-part – depending only from some probability $\pi \in [0, 1]$ – the description of those expressions which shall be deleted E^{-} and those which shall be newly generated E^{+}. A further distinction is between those expressions Φ which contain *numbers* and those which don't. written as:

IF Φ **THEN** $\pi_{e-} : E^{-} \wedge \pi_{e+} : E^{+}$

Example 1:

S={A house is burning in the city AAA}.
X=IF {A house is burning in the city AAA} THEN with $\pi_{e-} = 1 : E^{-} = \emptyset$, $\pi_{e+} = 0.9 : E^{+}$={The fire brigade is coming immediately}.
S'=S - $E^{-} \cup E^{+}$
S'=S $\cup$ {The fire brigade is coming immediately}

Example 2:

S={The city AAA has 10000 inhabitants and a negative migration rate of 600.}.
X=IF {The migration rate of city AAA is bigger than 500} THEN $\pi_{e-} = 1 : E^{-}$ = {The city AAA has 10000 inhabitants}, $E^{+}, \pi_{e+} = 1$: {The city AAA has 9400 inhabitants}, $\pi_{e+=0.8}$: {The number of inhabitants of city AAA will degrade a lot in the future.}.

Because the migration rate is bigger than 500 the condition is satisfied:
S'=S - $E^{-} \cup E^{+}$
S'=S $\cup$ {The city AAA has 9400 inhabitants,The number of inhabitants of city AAA will degrade a lot in the future}

Inference Rules with Actors: The difference to the actor-free inference rule consists in the additional call to an actor:

IF Φ **THEN** *ACTOR()* $= E^{-} \wedge E^{+}$

Within this explicit call to an actor two main cases will be distinguished:

1. **Deterministic Actor:** When a deterministic actor will be called then the actor will process a *well defined function* and will output the result in the format of expressions to be deleted or to be created.
2. **Non-Deterministic Actor:** When a non-deterministic actor will be called then the response of the actor depends besides other things also from the *actual inner states* which are the *result of the history of events in the past*. Here two basic types of non-deterministic actors are distinguished: *biological* actors or *non-biological* actors. If both types of actors can be *simulated* in some way, then the computation can be done within the normal simulation. If simulations are not available then these non-deterministic actors have been 'played' by *real actors*.

Example 3:

The idea is that a deterministic actor can realize some fixed process. In this example there are data know about the population of the city XXX. A deterministic actor can be a function which can compute the *effect* of all these factors expressed in the changing population number.

S={The city AAA has 10000 inhabitants, a negative migration rate of 600, a death rate of 0.118%, and a birthrate of 0.13%.}.
X=IF {The city AAA has P inhabitants, a negative migration rate of MN, a death rate of DR%, and a birthrate of BR%.} THEN *demographicActor(P inhabitants, a negative migration rate of MN, a death rate of DR%, a birthrate of BR)* $= E^{-} \cup E^{+}$
S'=S - $E^{-} \cup E^{+}$

If we define the *demographicActor()* as follows:

def demographicActor(P,-M.DR,BR):
*P=P+(P*BR)-(P*DR)-MN*

... some formatting ...
return P

Then we will get the following *output*:

E^- ={The city AAA has 10000 inhabitants, a negative migration rate of 600, a death rate of 0.118%, and a birthrate of 0.13%.},
E^+ ={The city AAA has 9520 inhabitants, a negative migration rate of 600, a death rate of 0.118%, and a birthrate of 0.13%.}

Example 4:

A non-deterministic actor can react based on his collected experience from the past. Perhaps there is a non-deterministic actor which knows about the *motifs* why people do not like to stay in city XXX. In this case this actor can set up a goal to stop the negative movement of people away from city XXX. Thus he can propose for the city parliament to set up an agenda against the negative migration.

S={The city AAA has 10000 inhabitants, a negative migration rate of 600, a death rate of 0.118%, and a birthrate of 0.13%.}.
X=IF {The city AAA has 10000 inhabitants, a negative migration rate of 600, a death rate of 0.118%, and a birthrate of 0.13%.}
THEN *councillorActor(10000 inhabitants, a negative migration rate of 600, a death rate of 0.118%, a birthrate of 0.13)* $= E^- \cup E^+$
S'=S - $E^- \cup E^+$

If we define the *councillorActor()* as follows:

def councillorActor(p,br,dr,mgr-)
based on the facts develop a proposal for the city council
return proposal

Then we will get the following *output*:

$E^- = \emptyset$,
E^+ ={Proposal for the city council how to act}