Chapter 13

Temporal and Contextual Reasoning in PLN

In this chapter we review the temporal and causal PLN relationship types and rules that are used to guide these sorts of inference in PLN, and give some simple examples to illustrate how they are used. In the following chapters we will present more elaborate examples of spatiotemporal reasoning, using these constructs and ideas.

13.1 Temporal relationship types

First, the notation

\[
\text{AtTimeLink} < \text{TV} >
\]

\[
\begin{align*}
T \\
E
\end{align*}
\]

means that the event E holds during T, where T is a time interval.

So for example:

\[
\text{AtTimeLink} < .9, .8 >
\]

\[
\]

Evaluation

\[
\begin{align*}
\text{Sick} \\
\text{Bob}
\end{align*}
\]

means that Bob is sick with degree 0.9 at confidence 0.8 from the 10th of March 2007 to the 14th of March 2007.
The time format in the examples is arbitrary and matters little, in practice it is an integer corresponding to the number of time units – a time unit could be 10ms for instance – that have passed since a referential beginning date, the zero time.

The relationships initiatedAt and terminatedAt represent respectively when an event starts and stops. So for instance the example above can be similarly expressed by:

And

\[
\text{initiatedAt} < .9, .8 > \\
10:\text{March:}2007 \\
\text{Evaluation Sick Bob} \\
\text{terminatedAt} < .9, .8 > \\
14:\text{March:}2007 \\
\text{Evaluation Sick Bob}
\]

Sometimes, that notation is not enough to characterize the temporal aspect of an event. For instance one may want to express that an event has started within an interval, or similarly ended within an interval. For that the temporal relationships initiatedThroughout and terminatedThroughout are used:

For instance if Bob has gotten progressively sick and healed progressively too:

And

\[
\text{initiatedThroughout} < .9, .8 > \\
[10:\text{March:}2007, 11:\text{March:}2007] \\
\text{Evaluation Sick Bob} \\
\text{terminatedThroughout} < .9, .8 > \\
[13:\text{March:}2007, 14:\text{March:}2007] \\
\text{Evaluation Sick Bob}
\]

means that the 10th of March Bob was sick with degree 0 and then that degree progressively increased till the 11th of March.

Given these primitives it is possible to express other temporal relationships like OverlapTime which represents how much 2 time intervals overlap:

\[
\text{OverlapTime} < .8 > \\
[\text{Monday, Wednesday}]
\]