Target Driven Activity Planning

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How can we continuously generate and schedule activities under the constraints of behavioral realism and algorithmic efficiency?
How can we *continuously generate and schedule activities under the constraints of behavioral realism and algorithmic efficiency*?

- Agents make decisions *on the fly* with an *open time horizon* (multiday)
- Use parameters that are close to observed behavior
- Use a *decision heuristic* (greedy as-we-go approach) and go parallel
Overview

- Components of our model
  - Targets
  - Projects
  - Effectiveness

- Decision heuristic

- Q&A
Targets
Targets

Convolution with an exponential kernel

→ exponentially weighted moving average
Targets

Possible values:

- Average time spend for an activity
- Average execution frequency of an activity
A person would like to play $2^{+0.5}_{-1}$ hours of tennis about $2^{+1}_{-1}$ times per week.
A person would like to play \( 2^{+0.5}_{-1} \) hours of tennis about \( 2^{+1}_{-1} \) times per week.
A person would like to play $2^{+\frac{1}{2}}$ hours of tennis about $2^{-1}$ times per week.
A person would like to play about $2^{-1}_1$ times per week. 2^{+0.5} -1 hours of tennis.
“play tennis” behavior of a person (influenced by project “vacation”)

(1) is on vacation

(2) after vacation (work off what has been put aside)

(3) back to normal course of life
Projects temporally modify reference values of targets.
Discomfort Measure

→ Defines urgency an agent experiences to change its current situation
Heuristic (Discomfort)

Discomfort Measure

→ Defines urgency an agent experiences to change its current situation

\[ D(t) = \sum_{k=1}^{n} (f_{refVal}^{k}(t) - f_{monVal}^{k}(t))^2 \cdot \begin{cases} w_1^k & \text{if } f_{monVal}(t)_k \leq f_{refVal}(t)_k \\ w_2^k & \text{otherwise} \end{cases} \]

\[ w_1^k = \frac{1}{(f_{refVal}^{k}(t) - f_{lower-bandwidth}^{k}(t))^2} \]

\[ w_2^k = \frac{1}{(f_{refVal}^{k}(t) - f_{upper-bandwidth}^{k}(t))^2} \]
Effectiveness of an activity execution at a specific time

- **Shop opening hours** for a **shopping** activity
- **Daylight intensity** for a **sleep** activity
- **Business hours** for a **work** activity

![Example of shop opening hours]
Heuristic (Look-Ahead)

Look-Ahead Measure

→ Indication about future opportunities

$$LA(t) = \begin{cases} 
1 + w_1 \cdot \left(1 - \int_{0}^{h} f_{effect}(t + x) \cdot \text{kernel}(x) \, dx\right) & \text{if } f_{effect}(t) > u \\
1 & \text{otherwise}
\end{cases}$$

look-ahead measure through convolution with an exponential kernel
Heuristic (Look-Ahead)

Look-Ahead Measure

→ Indication about future opportunities

$$LA(t) = \begin{cases} 
1 + w_1 \cdot (1 - \int_0^h f_{effect}(t + x) \cdot kernel(x) \, dx) & \text{if } f_{effect}(t) > u \\
1 & \text{otherwise}
\end{cases}$$
Decision Heuristic

- considers activities which can be executed (or are executed based on cultural/social norms)
- considers activities which give more discomfort reduction per spent time
- simplistic location choice procedure
- favors activities which have fewer execution options in the future
Conclusion & Outlook

- Agents *behave* as expected *artificial* examples
- Rework code (performance / parallel framework)

- More simulation runs for validation using a 6 week travel diary (similar to Mobidrive)
- Location choice