ML-BDI Agents: Vision and Survey

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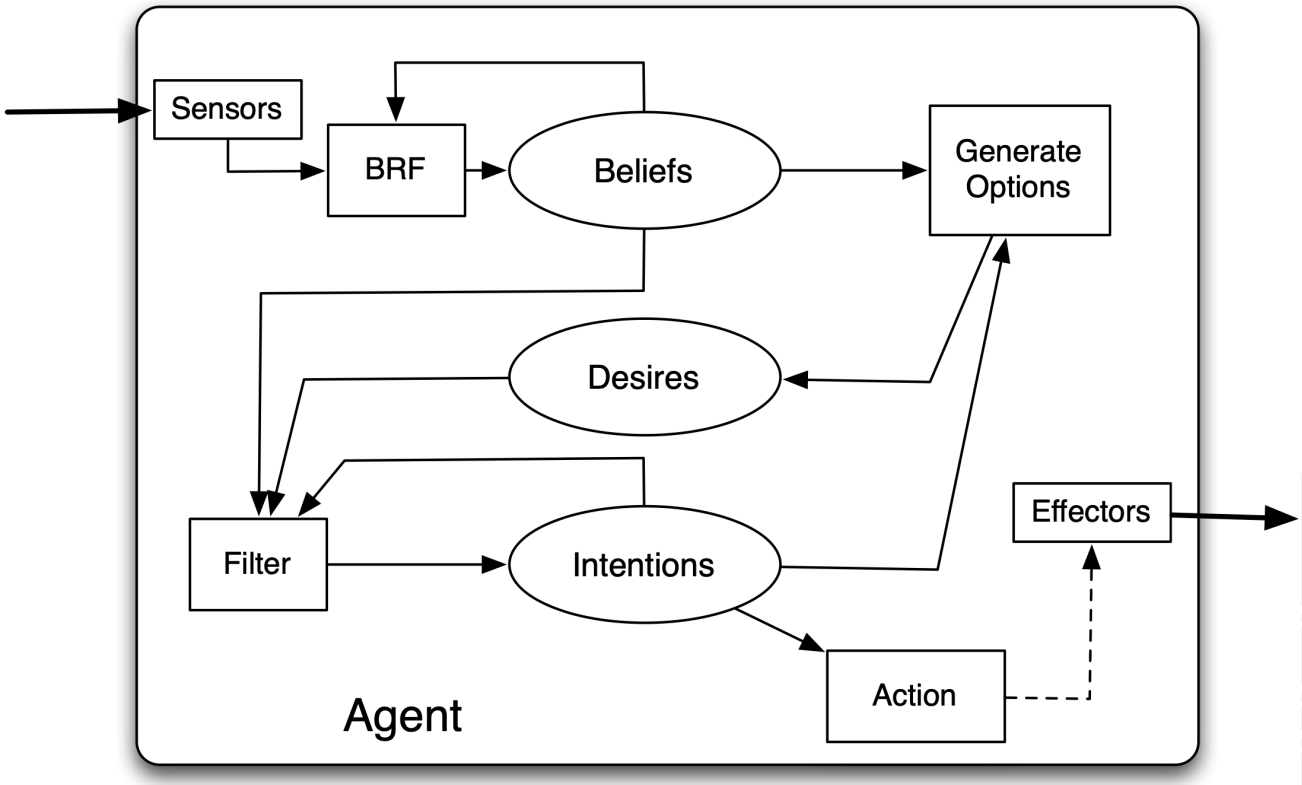
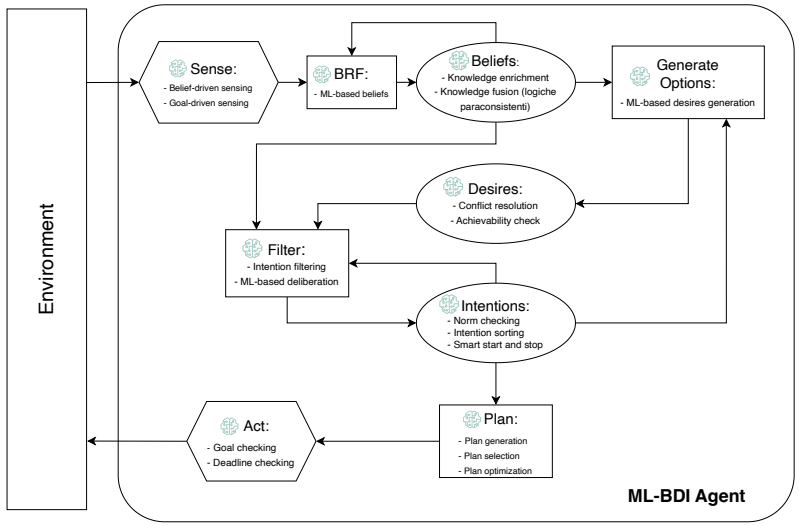
ML-BDI Agents: Research Question

- Given Wooldridge BDI basic architecture [12]
- **RQ**: how can ML be integrated in each BDI component?



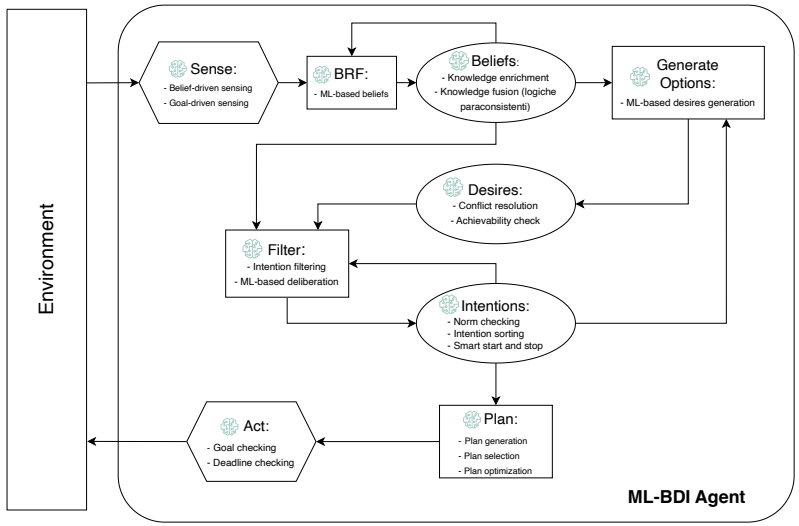
ML-based Sensing

- *ML-based sensing*: computer vision (CV) [13] and more.
- *Belief-driven sensing*: use ML for sensing (as in CV), but depending on the agent's beliefs. Beliefs give intuition on the sensing focus.
- *Goal-driven sensing*: like belief-driven sensing, but depending on the agent's goals or desires.
- Others?



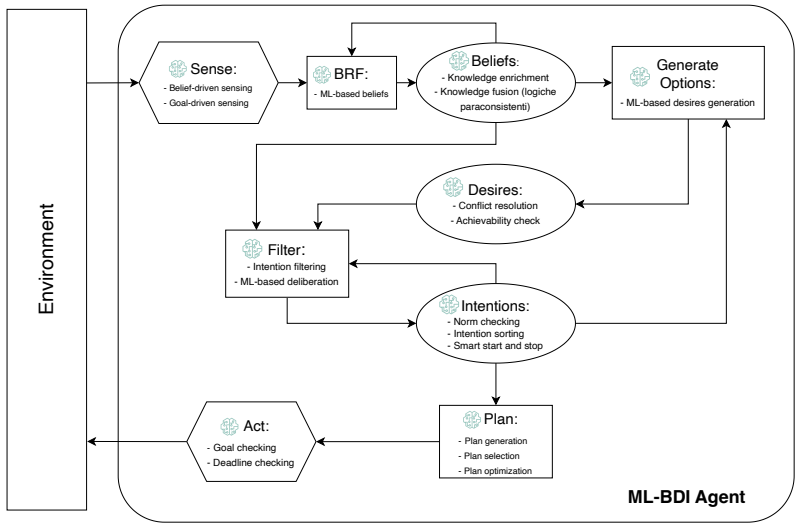
ML-based Belief revision & update function (BRF & BUF)

- *ML-based beliefs*: is it possible to use ML to convert sense outputs into beliefs?
  - use ML model to convert sensed data into diagnosis belief in health-care agents [7]
  - natural language beliefs in conversational agents [3]
- Others?



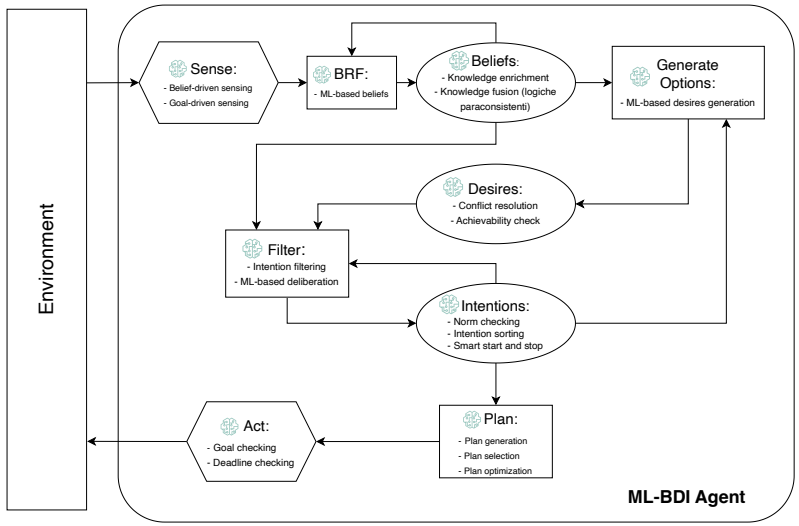
ML-based Beliefs

- *Knowledge enrichment*: given current beliefs use ML to define new valid beliefs (Knowledge graphs completion [9], ILP [4])
- *Knowledge fusion*: given current agent's beliefs and other agents beliefs use ML to merge these beliefs onto a valid set of beliefs (Knowledge graphs fusion [8])
- Others?



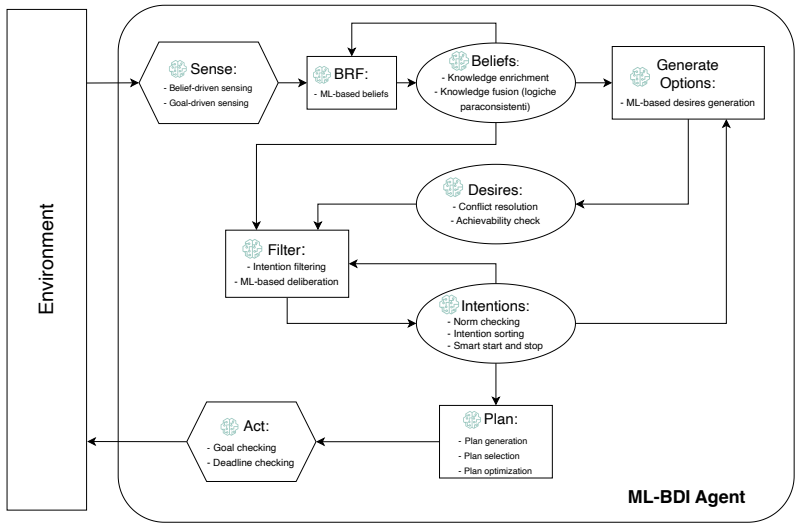
ML-based Desires

- *Conflict resolution*: given set of desires use ML to check if any desire is incosistent with each other (inside single agent and among different agents). Use ML to speed-up the conflict check.
- *Achievability check*: use ML to check if new (or any) desire is achievable within the agent's environment (e.g., robot desiring to reach a room but stairs are in the way).
- Others?



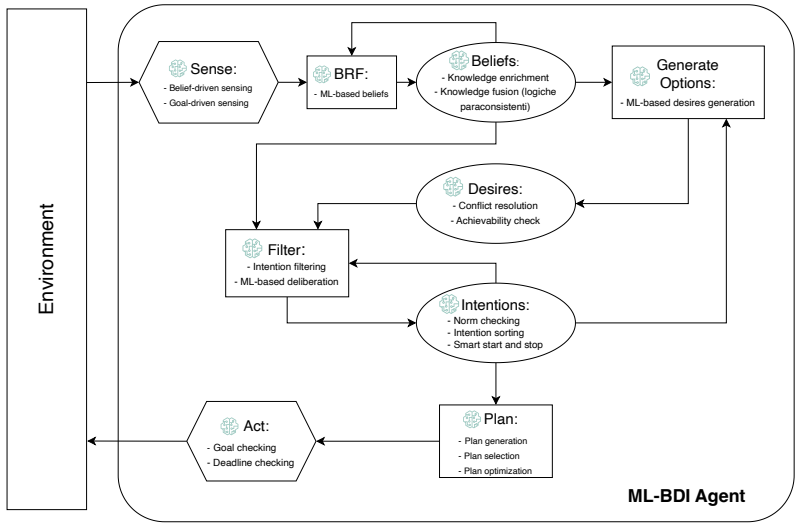
ML-based Intentions

- *Norm checking*: use ML to check if any intention suits the agent's or environment's norm/law. Use ML to speed-up the check.
- *Intention sorting*: use ML to sort intention depending on their relevance/reward [2].
- *Smart start and stop*: depending on the environment and agent status it may be worth to temporarilly block an intention.
- Others?



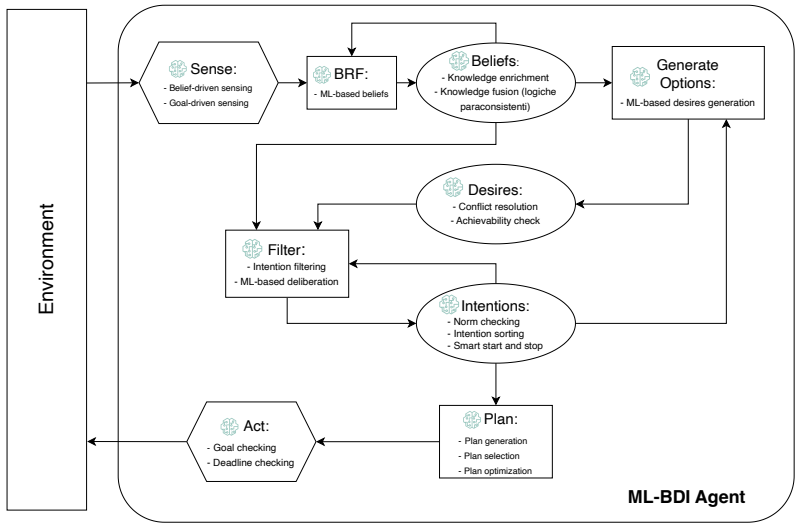
ML-based Option generation

- *Desire generation*: use generative ML to generate desires given beliefs and intentions (conversational agents with language-based baliefs and intentions).
- Others?



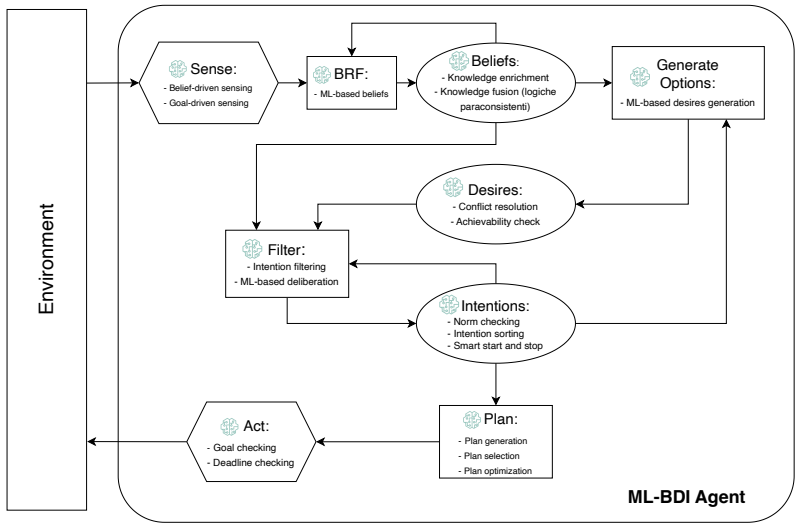
ML-based Filter

- *Intention filtering*: use ML to speed-up intention filtering.
- *Deliberation*: in multi-agents setup, use ML to find agreement among agents (ML-based argumentation [1], agument mining [5], etc.)
- Others?



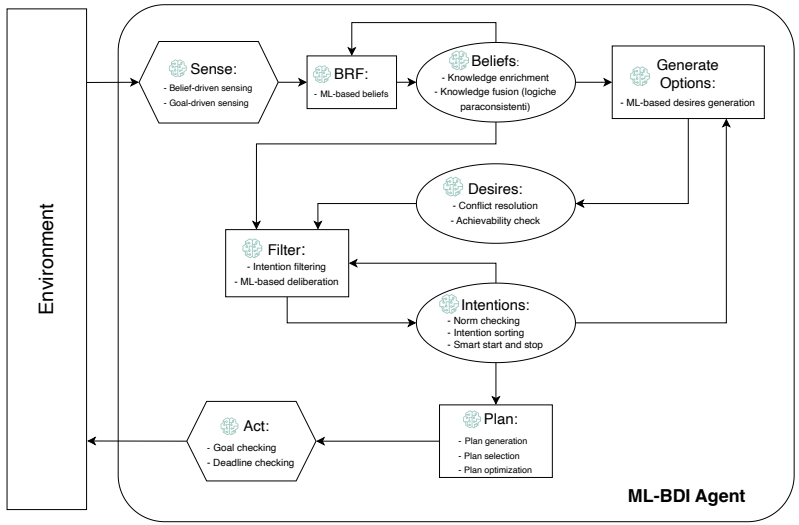
ML-based Plan

- *Plan generation*: use generative ML to create new plans once new beliefs, desires and intentions given (RL [6]).
- *Plan optimization*: use ML to identify plan shortcuts or alternative options (RL [10]).
- *Plan selection*: use ML to select best plan depending on expected reward or costs (RL [11]).
- Others?



ML-based Act

- *Goal checking*: use ML to estimate if the goal is reached or not (non-trivial goals only).
- *Deadline checking*: use ML to (preemptively) check if the goal is still reachable (avoid deadlocks or time/resource wastes).
- Others?



ML-BDI Agents

- **Ongoing SLR**
- Preliminary findings: some areas have been explored in the literature (e.g., plan & sensing) while others are almost completely untouched

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