Assisting cognitively overloaded users via Intelligent Information Management

**Recognize user plan:** infer user’s current and future activities from observed user behavior and environmental changes to identify user’s information needs.

**Pre-fetch relevant information:** retrieve information efficiently by reasoning about resource constraints and statistical properties of various information sources to maximize user plan quality.

**Estimate user cognitive workload:** measure the user’s workload to determine the appropriate level of assistance.

**Present information:** prepare information in formats that are cognitively aligned with user.

**Collect feedback:** learn to adjust assistive plans using user feedback as reinforcement.

**ANTicipatory Information and Planning Agent (ANTIPA)** brings information to the user as a result of user requests but most crucially, it proactively predicts the user’s prospective information needs by recognizing the user’s plan; pre-fetches information that is likely to be used in the future; and offers the information when it is relevant to the current or future planning decisions.

**Current state recognizer**
- Activated when the agent cannot observe user states directly.
- Interpret primitive observations from sensory devices, e.g., keyboard and mouse inputs.
- Maintain probability distribution over a set of user states (known as belief state) given a series of observations.

**Future plan predictor**
- Decision theoretic assumption: users aim to maximize plan quality.
- Probabilistic prediction.
- Markov Decision Process (MDP) based model of user’s planning process.
- Produces plan-tree of predicted user actions labeled with priorities and deadlines.

**Information gatherer**
- Estimate quality of information and retrieval time based on source properties.
- Incrementally schedule information gathering tasks.
- Trade off information quality and deadline constraints.
- Constrain network resource usage to avoid interfering with the user.

**Information presenter**
- Identify information that is relevant to user’s current state.
- Estimate user cognitive workload.
- Determine the level of details according to user cognitive workload.
- Determine modality of information suitable for user’s current state.
- Present information in an unobtrusive way.