**Interactive Ranking of Skylines Using Machine Learning Techniques**

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### Algorithm Design

**Base Learner:** Noise tolerant perceptron with margin.

**Training Data:** A set of revealed (pairwise) preferences \( a \prec b \), turned into positive and negative examples for classification.

**Monotonicity:** \( a \geq b \Rightarrow U(a) \geq U(b) \) must be guaranteed for all \( a, b \in O \).

**Utility:** Linear model \( U(a) = \langle w, a \rangle = w_1a_1 + \ldots + w_d a_d \) (monotonicity holds if \( w \geq 0 \)) and kernalized version.

**Bayes Point Machine:**

Approximation of the Bayes point by the center of mass of version space.

**Active Learning Strategy:**

1. Construct a committee of learners.
2. Find two maximally conflicting learners.
3. For each learner, generate a corresponding ranking.
4. Return the first discordant pair as a query. Add the answer to the preference set.
5. Retrain the committee on the enlarged preference set and go to step 2.

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### Experimental Results

**Workflow:**

- Compute the skyline
- Receive initial preferences
- Train a model and induce a ranking
- Generate a query
- Add answer to training data

**Ensemble (Bayes point machine) vs. single learner:**

- Noise tolerant perceptron with margin.
- Bayes Point Machine: version space.
- Ensemble (Bayes point machine) vs. single learner.

**Active vs. non-active learning:**

- Noise tolerant perceptron with margin.
- Bayes Point Machine: version space.
- Active vs. non-active learning.