Budgeted Optimization with Concurrent Stochastic-Duration Experiments

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**Bayesian Optimization (BO)**

**Goals:** maximize an unknown function $f$ by requesting a small set of function evaluations

- Assume a prior on $f$ is available (e.g. Gaussian Process)

**Current Experiments**

**Posterior Model**

**Select Experiment(s)**

**Run Experiment(s)**
Problem:
Schedule when to start new experiments and which ones to start.

We consider the following:
- Concurrent experiments (up to $l$ exp. at any time)
- Stochastic exp. durations (known distribution $p$)
- Experiment budget (total of $n$ experiments)
- Experimental time horizon $h$
**Challenges**

**Objective 1**: complete all $n$ experiments with high prob. within horizon (favors maximizing concurrency)

<table>
<thead>
<tr>
<th>Lab 1</th>
<th>$x_1$</th>
<th>$x_4$</th>
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<tbody>
<tr>
<td>Lab 2</td>
<td>$x_2$</td>
<td>$x_5$</td>
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<td>Lab 3</td>
<td>$x_3$</td>
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<td>Lab 4</td>
<td>$x_4$</td>
<td>$x_7$</td>
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**Objective 2**: maximize info. used in selecting each experiment (favors minimizing concurrency)

| $x_1$ | $x_2$ | ... | $x_n$ |

We present online and offline approaches that effectively trade off these two conflicting objectives.

*Poster #W052*