Methods for Including Concept Drift in MBO

- Naive approach: If concept drift detected: Discard previous evaluation, refit surrogate model
- Historical approach: If concept drift detected: Keep best previous settings and refit surrogate model
- Fixed window approach: Consider only evaluations observed in the last \( t_d \) time units
- Weighted window approach: Fixed window + newer evaluations are weighted higher for surrogate model
- Flexible window approach: Window approach with adaptive \( t_d \)
- Time-as-covariate: Include time as additional dimension in the surrogate model
- Window and time-as-covariate: Window + Time-as-covariate

Problems that Fit the Black-Box Paradigm

- Optimizing analysis pipeline for virus detection with the PAMCLONO sensor, with optimization regarding energy consumption and runtime
- Tuning deep neural networks
- Mapping of TensorFlow pipeline to improve efficiency
- Tuning the prediction of data rate of mobile devices in cellular networks
- Industrial production processes: Optimizing the prediction of product quality
- Optimizing the prediction of travel-times by guiding the selection of the best algorithm that considers environmental conditions
- Survival prediction of heterogeneous cancer cohorts

Challenges of Executing MBO Efficiently

- Minimization of idle times
- Multiple computation units (i.e., multicore systems)
- Heterogeneous computation units (i.e., GPU, processors)
- Different memory and communication overheads
- Parallelization and concurrent execution

Utilize Resources Efficiently

- Migration mechanism between different CPUs will be established, so that the pieces of idle time of the CPUs can be utilized efficiently
- Cancellation (CEL) of Expected Improvement (EI) will be explored, e.g., \( E(I(\theta_1, \theta_2)) - E(I(\theta_1)) + E(I(\theta_2)) - CEL \) (w.r.t. \( \delta_1, \delta_2, \theta_1, \theta_2 \))
- Relationship between candidates has to be considered to maximize the total EI
- EI under concept drift has to be carefully managed, e.g., whether an unfinishing evaluation of a point should be aborted or continued

WP1: MBO with concept drift (MBO-CD)
- Implement different methods for CD in MBO
- Evaluate methods on benchmarks, both with synthetic function and real data sets
- Find principles about relationship between data situation and best method

WP2: RAMBO with flexible scheduling
- Develop scheduling methods to use available resources efficiently and adaptively
- Optimize for communication and memory access including distributed computing, multicore platforms, GPUs, and accelerated machine learning hardware

WP3: RAMBO with concept drift (RAMBO-CD)
- Combine resource-aware MBO with CD
- Explore the impact of dynamic EI in RAMBO
- Develop and evaluate aborting strategies for jobs that were selected earlier for now outdated concepts

WP4: RAMBO with small sample size
- Mobile Data Rate prediction
- TensorFlow Pipeline
- PAMCLONO Pipeline
- Tuning Deep Neural Networks

WP5: RAMBO for data streams
- Job Selection
- Scenarios and Cooperations:
  - Mobile Data Rate prediction
  - TensorFlow Pipeline
  - PAMCLONO Pipeline
  - Tuning Deep Neural Networks

WP6: RAMBO-CD with interactive selection of samples
- Augment Active Learning with an automatic algorithm configuration
- Interactively select the next data points to be labeled considering the currently best machine learning method