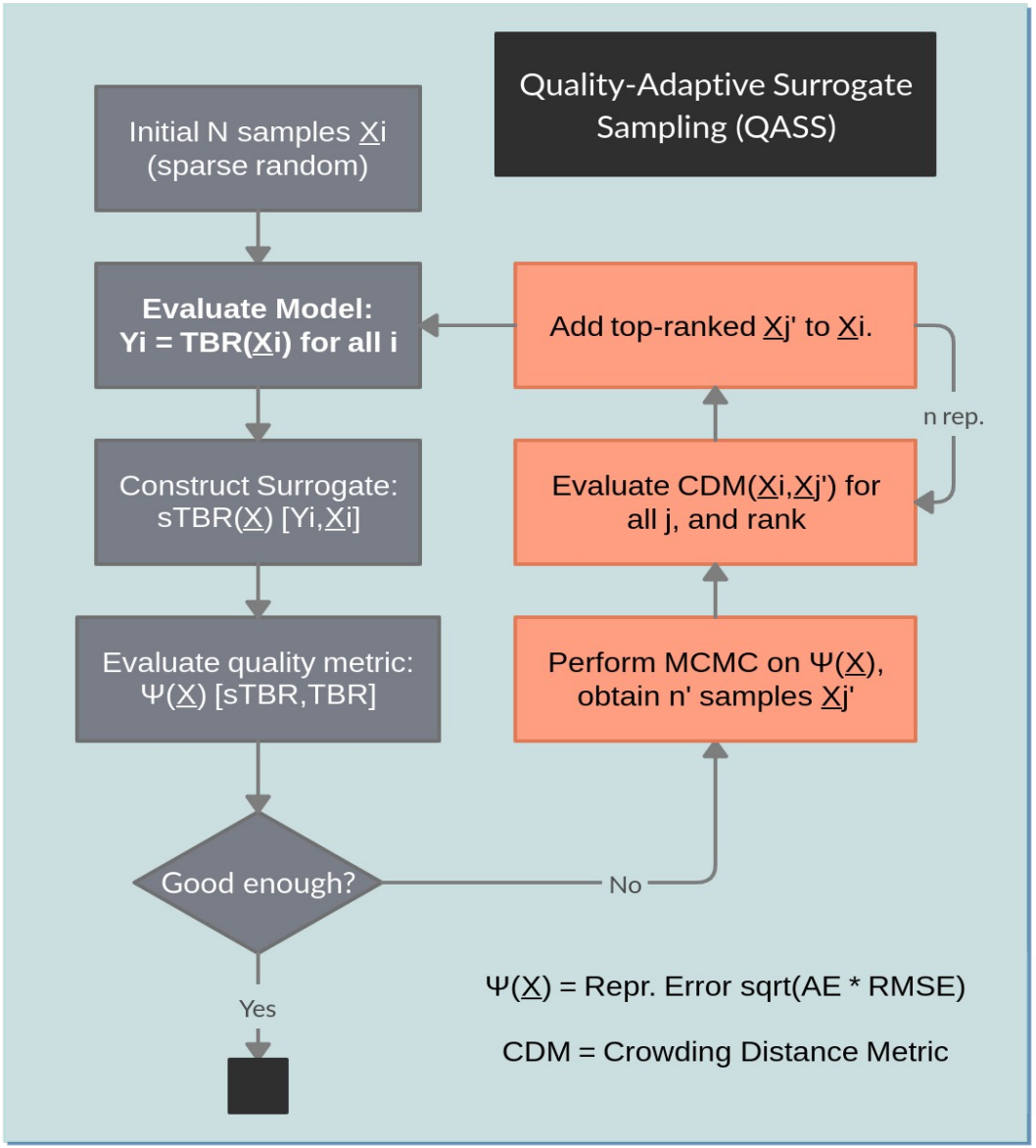
Adaptive Sampling: Methodology

- Number of samples needed to train a surrogate can be lowered by choosing **smarter samples**.
  - Samples are selected incrementally during training, rather than upfront.
  - Adaptive sampling techniques in the literature use mostly deterministic error and crowding metrics to identify new sample points.
- Markov-Chain Monte Carlo (MCMC) statistical methods use random walks to generate representative samples of probability distributions.
- **Quality-Adaptive Surrogate Sampling (QASS)**: a novel algorithm which takes advantage of MCMC stochasticity to optimise sample selection.
  - A surrogate quality distribution is constructed by nearest-neighbour interpolation on test sample error values.
  - Sampling is then prioritised in regions where surrogate error is the greatest.



Adaptive Sampling: Results

- Basic functionality demonstrated on a sinusoidal toy model for the Paramak TBR parameter space.
  - Performance varied only weakly with MCMC depth on each iteration, avoiding a potential bottleneck.
- QASS was compared with a baseline scheme of uniformly-random incremental sampling.
  - QASS achieved better precision on its own validation set, but lost out on a uniformly-random baseline set.
  - A 50/50 mixed scheme of adaptive and uniform incremental samples captured the best of both worlds.
- Interpretation: QASS improves surrogate quality in hard-to-reach places at the cost of broad overall precision.