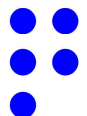# Lecture 23: Bayesian global optimization
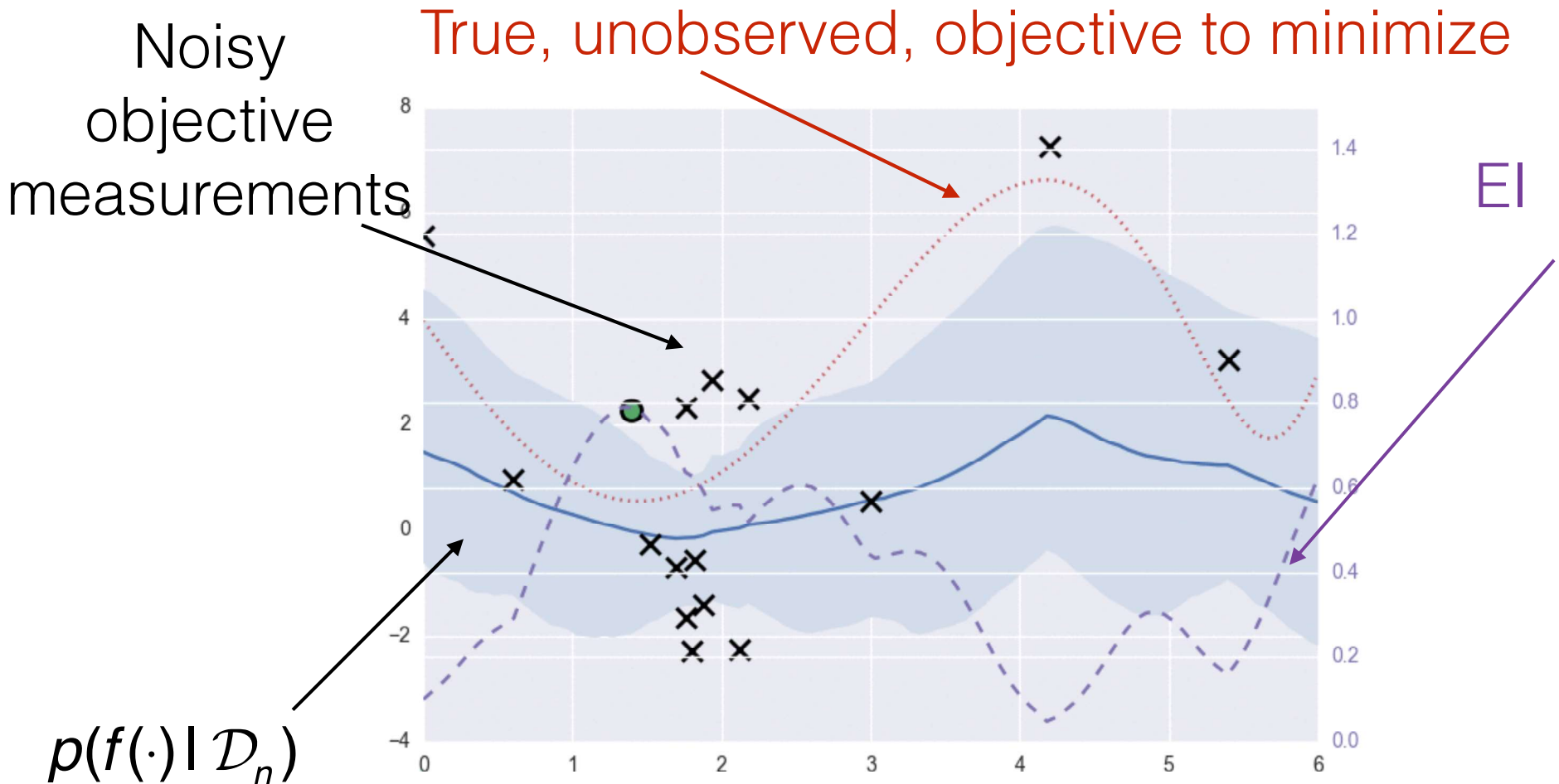
Professor Ilias Bilionis

Expected improvement - With observation noise

Expected Improvement for Noisy Functions

- Cannot use $\max_{1 \le i \le n} y_i$ because of the noise.

- Instead we use the maximum of the predictive mean of the observations: $\max_{1 \le i \le n} m_n^*(\mathbf{x}_i)$.

- And also, instead of comparing to y (experimental observation), we are comparing to $f(\mathbf{x})$ conditional on y.

  $\hookrightarrow y_i = f(x_i) + \varepsilon_i$

- See notes for how EI is modified.

Example: Noisy minimization

Noisy objective measurements

True, unobserved, objective to minimize

EI

$p(f(\cdot)|\mathcal{D}_n)$

(Pandita and Bilionis, 2016)

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