OpenTURNS cheat sheet

This *OpenTURNS* v1.17 cheat sheet provides a quick overview of all the programming interface. For full documentation, please read the doc. A beginner may be interested in the Quick start guides.

This cheat sheet follows the steps of the ABC method.

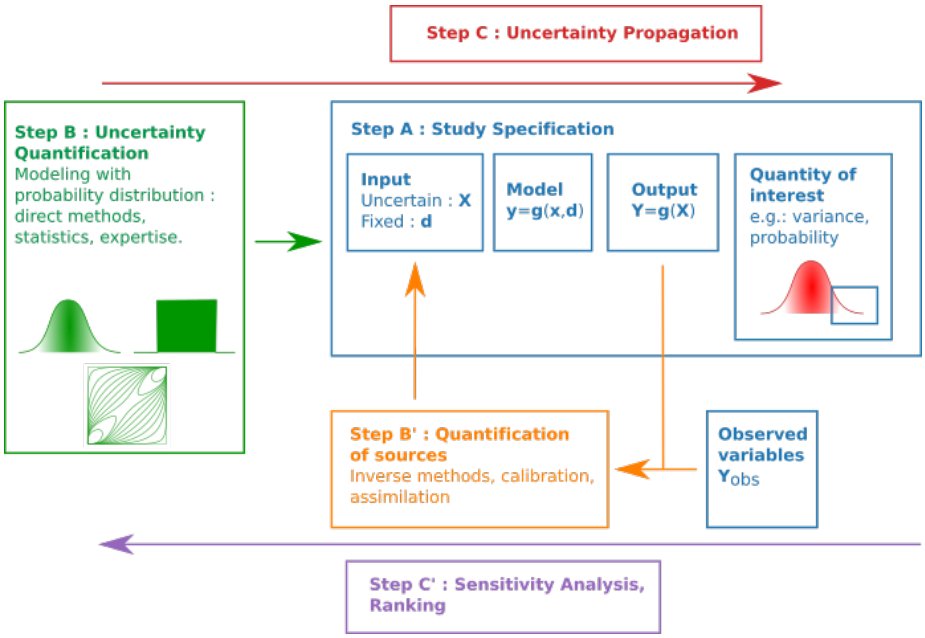

Figure 1: The ABC method

Step A : define the study

Purpose	Class / Method
Import *OpenTURNS*	`import openturns as ot`
Vector	`ot.Point(dimension)`
Sample	`ot.Sample(size, dimension)`
Symbolic function	`ot.SymbolicFunction(["x0", "x1"], ["1 + x0 + x1"])`
Python function	`ot.PythonFunction(number_of_inputs, number_of_outputs, py_function)`

Purpose	Class / Method
Manage history and cache	`ot.MemoizeFunction(g_function)`
Normal	`ot.Normal(mu, sigma)`
Uniform	`ot.Uniform(a, b)`
Multivariate distr., indep. copula	`ot.ComposedDistribution((dist_x0, dist_x1, dist_x2))`
Input random vector	`ot.RandomVector(input_distribution)`
Output random vector	`ot.CompositeRandomVector(g_function, input_random_vector)`
Generate observations	`randomVector.getSample(sample_size)`
Set the seed	`ot.RandomGenerator.SetSeed(1)`
Get sample size	`sample.getSize()`
Get sample dimension	`sample.getDimension()`
Sample mean	`sample.computeMean()`
Sample st. dev.	`sample.computeStandardDeviation()`

Step B : quantification of the sources of uncertainties

Purpose	Class / Method
Fit a Normal	`ot.NormalFactory().build(sample)`
Fit a Beta	`ot.BetaFactory().build(sample)`
Fit an histogram	`ot.HistogramFactory().build(sample)`
Fit a kernel density estimator	`ot.KernelSmoothing().build(sample)`
Draw QQ-plot	`ot.VisualTest.DrawQQplot(sample, distribution)`
Kolmogorov-Smirnov test (known parameters)	`ot.FittingTest.Kolmogorov(sample, distribution)`
Kolmogorov-Smirnov test (unknown parameters)	`ot.FittingTest.Lilliefors(sample, factory)`
BIC criteria	`ot.FittingTest.BIC(sample, distribution)`

Step C : push forward the uncertainties

Purpose	Class / Method
Taylor expansion	`ot.TaylorExpansionMoments(output_random_vector)`
Estimate mean	`ot.ExpectationSimulationAlgorithm(output_random_vector)`
Estimate P(Y > s)	`sample.computeEmpiricalCDF(s, True)`
Create the event (Y > s)	`ot.ThresholdEvent(output_random_vector, ot.Greater(), s)`
Create a Monte-Carlo experiment	`ot.MonteCarloExperiment()`

Purpose	Class / Method
Estimate a probability	`ot.ProbabilitySimulationAlgorithm(myEvent, experiment)`

Step C' : sensitivity analysis

Purpose	Class / Method
Perform linear regression	`ot.LinearLeastSquares(input_sample, output_sample)`
Standardized regression coefficients	`ot.CorrelationAnalysis_SignedSRC(input_sample, output_sample)`
Draw indices	`ot.SobolIndicesAlgorithm.DrawCorrelationCoefficients(src_i input_names, "SRC coefficients")`
Estimate Sobol' indices given budget	`ot.SobolIndicesExperiment(distribution, sample_size)`
Estimate Sobol' indices	`ot.SaltelliSensitivityAlgorithm()`

Step B' : calibration

Purpose	Class / Method
Create the parametric model	`ot.ParametricFunction(g_function, calibrated_indices, theta_prior)`
Linear least squares	`ot.LinearLeastSquaresCalibration(parametric_g, input_sample, output_sample, theta_prior, "SVD")`
Non linear least squares	`ot.NonLinearLeastSquaresCalibration(parametric_g, input_sample, output_sample, theta_prior)`
Linear gaussian	`ot.GaussianLinearCalibration(parametric_g, input_sample, output_sample, theta_prior, theta_sigma, output_covariance)`
Non linear gaussian	`ot.GaussianNonLinearCalibration(parametric_g, input_sample, output_sample, theta_prior, theta_sigma, output_covariance)`

Purpose	Class / Method
Bayesian calibration	`ot.RandomWalkMetropolisHastings(prior, conditional, model, input_sample, output_sample, initialState, proposal)`

Metamodel

Purpose	Class / Method
Squared exponential	`ot.SquaredExponential([1.0] * dimension, [1.0])`
Matern 5/2 covariance	`ot.MaternModel([1.0] * dimension, 2.5)`
Kriging	`ot.KrigingAlgorithm(input_sample, output_sample, covarianceModel, basis)`
Sample from kriging	`ot.KrigingRandomVector(result, input_sample)`
Conditioned gaussian process	`ot.ConditionedGaussianProcess(kriging_result, mesh)`
Multivariate basis	`ot.OrthogonalProductPolynomialFactory(distribution_collect`
Polynomial chaos (given data)	`ot.FunctionalChaosAlgorithm(input_sample, output_sample)`
Polynomial chaos (given distribution)	`ot.FunctionalChaosAlgorithm(input_sample, output_sample, distribution, adaptive_strategy, projection_strategy)`
Sobol' indices from chaos	`ot.FunctionalChaosSobolIndices(functional_chaos_result)`
Sample from chaos	`ot.FunctionalChaosRandomVector(functional_chaos_result)`
Validation	`ot.MetaModelValidation(input_test, output_test, metamodel)`

Design of experiments

Purpose	Class / Method
Monte-Carlo	`ot.MonteCarloExperiment(distribution, sample_size)`
Latin Hypercube Sampling	`ot.LHSExperiment(distribution, sample_size)`
Optimized LHS	`ot.SimulatedAnnealingLHS(lhs_experiment, criteria, temperature_profile)`
Sobol' sequence	`ot.SobolSequence(dimension)`

Purpose	Class / Method
Low discrepancy sequence	`ot.LowDiscrepancyExperiment(ld_sequence, distribution, samplesize, False)`
Import viewer	`import openturns.viewer as otv`
Plot DOE	`otv.PlotDesign(sample, bounds)`

Graphics

Purpose	Class / Method
Import viewer	`import openturns.viewer as otv`
Graph	`ot.Graph(title, x_title, y_title, show_axes_bool)`
Curve	`ot.Curve(sample_x, sample_y)`
Cloud	`ot.Cloud(sample_x, sample_y)`
Pairs	`ot.VisualTest.DrawPairs(sample)`
Pairs with distribution	`ot.VisualTest.DrawPairsMarginals(sample, distribution)`
Parallel coordinate	`VisualTest_DrawParallelCoordinates(input_sample, output_sample, min_value, max_value, color)`
Set colors	`graph.setColors(ot.Drawable().BuildDefaultPalette(number_c`
Set size	`otv.View(graph, figure_kw={"figsize": (4.0, 3.0)})`
Move legend	`otv.View(graph, legend_kw={"bbox_to_anchor":(1.0, 1.0), "loc":"upper left"})`
Save figure	`view.getFigure().savefig("filename.pdf", bbox_inches="tight")`

More resources

Resource	Link
Forum	https://openturns.discourse.group
Chat	https://gitter.im/openturns/community
Modules	https://github.com/openturns/openturns/wiki/Modules
Install	http://openturns.github.io/openturns/master/install.html
Bugs	https://github.com/openturns/openturns/issues
Q&A	https://stackoverflow.com/questions/tagged/openturns
Events	https://github.com/openturns/openturns/wiki/OpenTURNS-events
Bibliography	https://github.com/openturns/openturns/wiki/Bibliography

Resource	Link
Bib resources	Bibtex file
Presentations	https://github.com/openturns/presentation