Using Goofit with Python

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```
pip install scikit-build cmake
pip install -v goofit
```
Python Bindings

Bind C++ PDFs in Python using PyBind 11

PyBind11

“A lightweight header-only library that exposes C++ types in Python and vice versa, mainly to create Python bindings of existing C++ code.”
from goofit import *
# Imports
from goofit import *
import numpy as np
import matplotlib.pyplot as plt

# Print GooFit and computer info
print_goofit_info()

# GooFit DataSet
xvar = Observable("xvar", -5, 5)
data = UnbinnedDataSet(xvar)

# Make a dataset from 90% gauss + 10% flat
dat = np.random.normal(0.2, 1.1, 100000)
dat[:10000] = np.random.uniform(-5, 5, 10000)
data.from_matrix([[dat], filter=True])
# GooFit PDFs and fitting variables
xmean = Variable("xmean", 0, 1, -10, 10)
xsigm = Variable("xsigm", 1, 0.5, 1.5)
signal = GaussianPdf("signal", xvar, xmean, xsigm)

constant = Variable("constant", 1.0)
backgr = PolynomialPdf("backgr", xvar, [constant])

sigfrac = Variable("sigFrac", 0.9, 0.75, 1.00)
total = AddPdf("total", [sigfrac], [signal, backgr])

# Do the fit
total.fitTo(data)
# Plot data
plt.hist(dat, bins='auto', label='data', normed=True)

# Make grid and evaluate on it
grid = total.makeGrid()
total.setData(grid)
main, gauss, flat = total.getCompProbsAtDataPoints()
xvals = grid.to_matrix().flatten()

# Plotting components
plt.plot(xvals, main, label='total')
plt.plot(xvals, np.array(gauss)*sigfrac.value, label='signal')
plt.plot(xvals, np.array(flat)*(1-sigfrac.value), label='background')

# Show the plot
plt.legend()
plt.show()
Welcome to Goofit

MnSeedGenerator: for initial parameters FCN = 522066.7325869
MnSeedGenerator: Initial state: - FCN = 522066.7325869 Edm = 185192 NCalls = 17
VariableMetric: start iterating until Edm is < 0.0001
VariableMetric: Initial state - FCN = 522066.7325869 Edm = 185192 NCalls = 17
VariableMetric: Iteration # 0 - FCN = 522066.7325869 Edm = 185192 NCalls = 17
VariableMetric: Iteration # 1 - FCN = 376648.6105226 Edm = 3943.49 NCalls = 34
VariableMetric: Iteration # 2 - FCN = 360521.5666858 Edm = 5807.81 NCalls = 47
VariableMetric: Iteration # 3 - FCN = 352534.4856178 Edm = 7510.83 NCalls = 60
VariableMetric: Iteration # 4 - FCN = 346873.7913056 Edm = 1176.23 NCalls = 71
VariableMetric: Iteration # 5 - FCN = 346087.7221632 Edm = 35.9524 NCalls = 81
VariableMetric: Iteration # 6 - FCN = 346039.8386063 Edm = 3.95918 NCalls = 91
VariableMetric: Iteration # 7 - FCN = 346035.4532991 Edm = 0.136684 NCalls = 101
VariableMetric: Iteration # 8 - FCN = 346035.2946238 Edm = 0.000453675 NCalls = 111
VariableMetric: Iteration # 9 - FCN = 346035.2941216 Edm = 1.28383e-06 NCalls = 121
VariableMetric: After Hessian - FCN = 346035.2941216 Edm = 9.35221e-07 NCalls = 148
VariableMetric: Iteration # 10 - FCN = 346035.2941216 Edm = 9.35221e-07 NCalls = 148

Minuit did successfully converge.
# of function calls: 148
minimum function Value: 346035.2941216
minimum edm: 9.35221e-07
minimum internal state vector: LAVector parameters:
0.020174159058528
0.1947783625819
0.05069256018299
-0.196578616221

minimum internal covariance matrix: LAGSymMatrix parameters:
1.2034046e-07 1.1078133e-09 -1.9815328e-16 3.0246173e-15
1.1078133e-09 2.4994541e-05 3.6994703e-15 6.7913938e-14
-1.9815328e-16 3.6994703e-15 9.0332142e-09 1.6764704e-10
3.0246173e-15 6.7913938e-14 1.6764704e-10 7.5440973e-06

# ext. || Name   || type      || Value      || Error +/-
0       || xmean   || limited   || 0.2017279064378 || 0.002452462911705
1       || xsigm   || limited   || 1.096774546666  || 0.00173416556426
2       || ymean   || limited   || 0.5907161356331  || 0.0006734395298746
3       || ysigm   || limited   || 0.3011712534656  || 0.0004761924636327

The minimization took: 888.16 ms
Average time per call: 6.01 ms
xmean: 0.201728 +/- 0.00245246 [-10, 10] GooFit index: 16 Fitter index: 0
xsigm: 1.09677 +/- 0.00173415 [0.5, 1.5] GooFit index: 17 Fitter index: 1
ymean: 0.590716 +/- 0.00067344 [-10, 10] GooFit index: 18 Fitter index: 2
ysigm: 0.301171 +/- 0.000476192 [0.1, 0.6] GooFit index: 19 Fitter index: 3
Features

Available Resources

● 9 out of 13 C++ examples available in Python
● Support from Python and PyBind11 community on development in Python

Features

● Simple Setup
● Easy to use
● Adding python functionalities is trivial
● Accessibility to new new Python bindings created
Run Goofit Now on Your Own Computer

Setup

```
pip install scikit-build cmake
pip install -v goofit
```

Use it in your python code

```
from goofit import *
```
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