Using Goofit with Python

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Setup

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

Features

- Simple installation like any Python module
- Easy setup - takes around 10-15 minutes in building files

Python Bindings with PyBind11

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.”

Using Goofit in Python Examples

```
from goofit import *
```

Addition.py - Example for Adding Two PDFs

```
# 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)
```

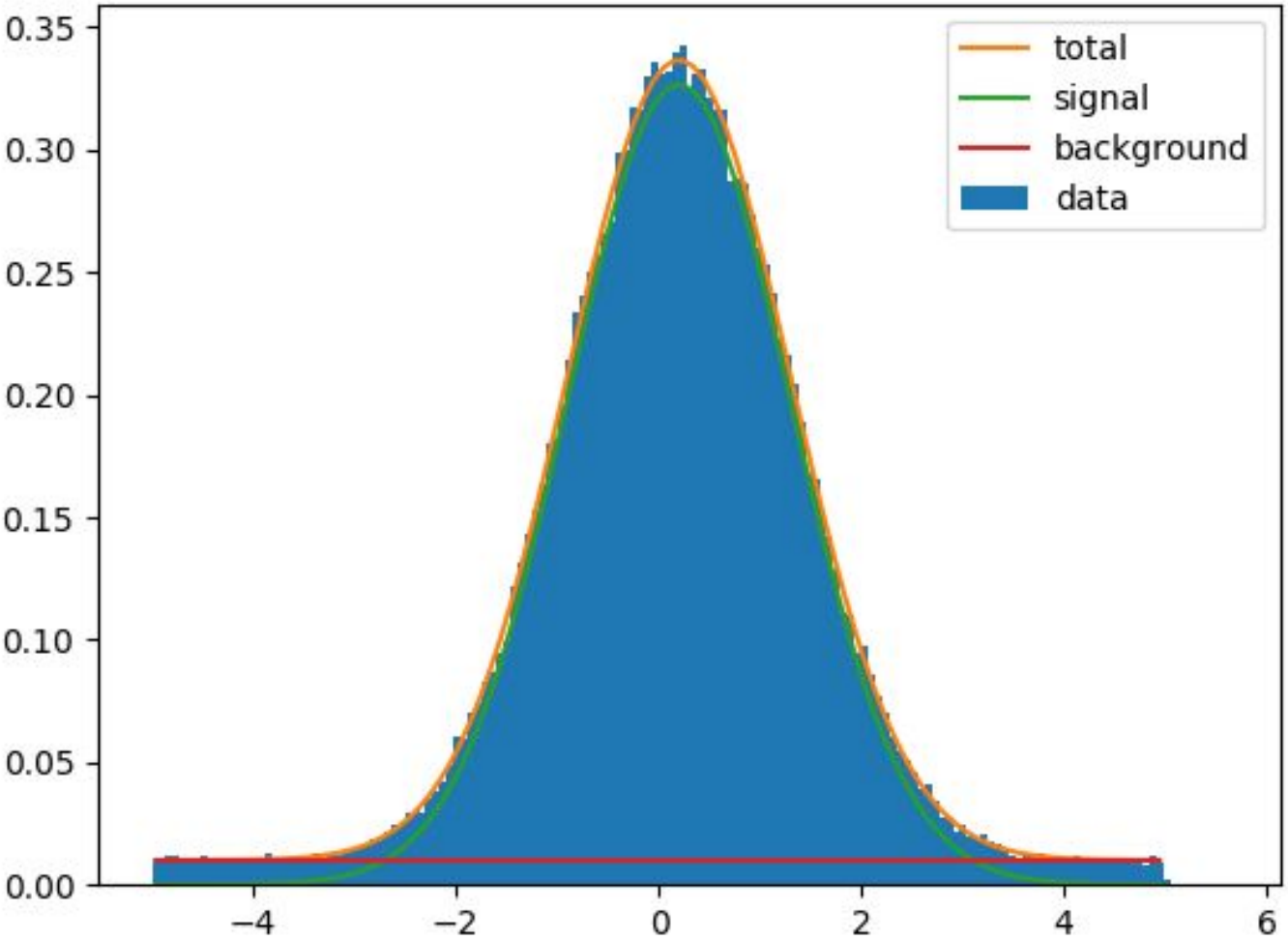
Addition.py

```
# 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)
```

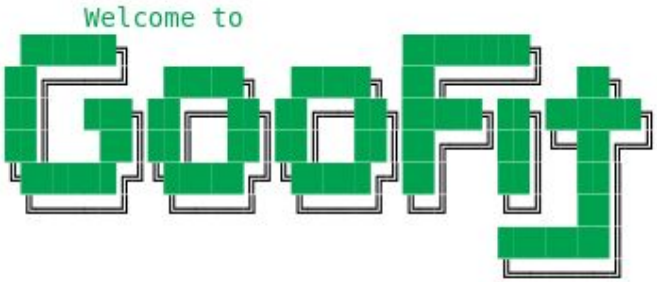
Addition.Py - Plotting Available in GooFit 2.1.1

```
# 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()
```

Addition.py - Generated Plot



Result




```
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: 9.352210805897e-07
```

Result

```
minimum internal state vector: LAVector parameters:
    0.02017415908528
     0.1947783625819
    0.05009256018299
    -0.1965786116221

minimum internal covariance matrix: LASymMatrix 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  9.0932142e-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 ||0.001734146556426
   2   ||     ymean || limited ||     0.5007161356331 ||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: 0.500716 +/- 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 *

Questions?

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