HARK-Python Documentation

Release 2.3.0

HARK

Dec 05, 2016

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CHAPTER

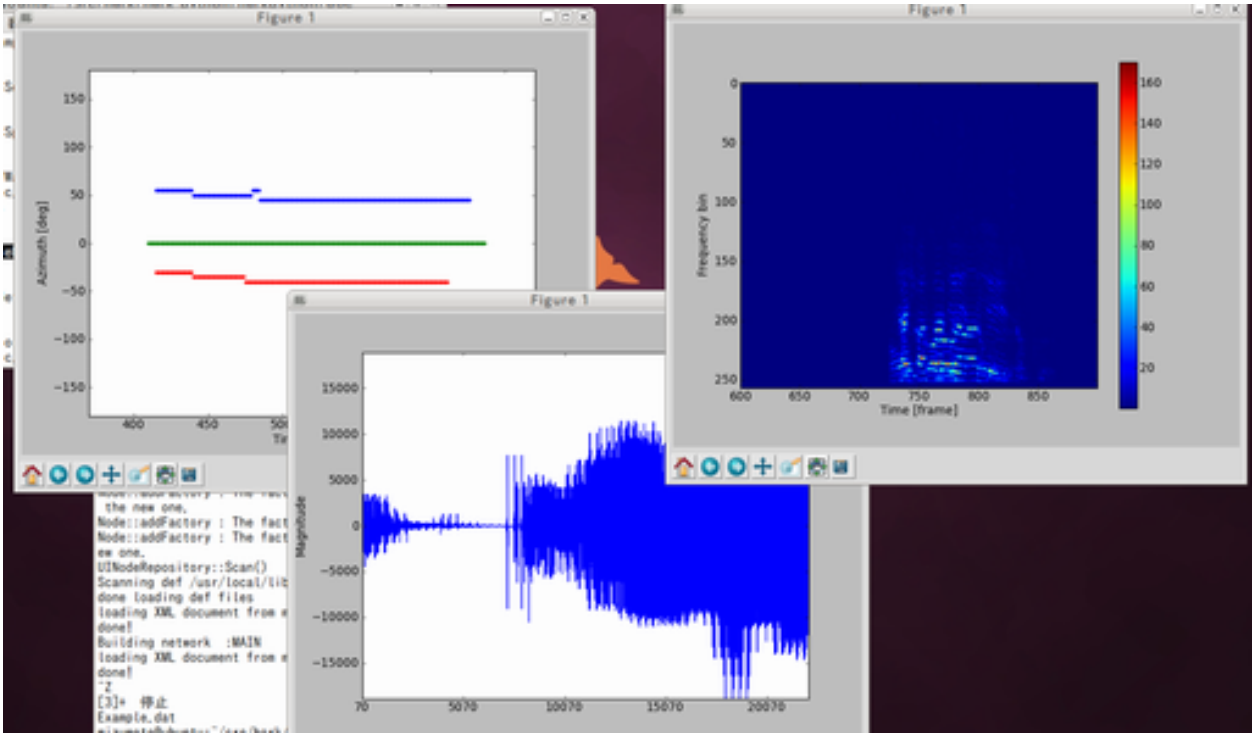
ONE

OVERVIEW

HARK Python is a package that enables Python code execution in HARK written using Boost.Python.

HARK Python provides two functions:

1. Data visualization nodes using matplotlib, a powerful visualization module for python
2. A wrapper to develop a HARK node using python.



CHAPTER

TWO

BENEFITS OF HARK-PYTHON

Rich visualization

The visualization of HARK basic packages is not rich enough. Only DisplayLocalization for visualizing localization results is provided. HARK-Python package provides visualization modules for

- waveform(`plotWaveform`)
- spectrogram (`plotSpec`)
- localization(`plotSource`)

Quick development of a new node

When you use PyCodeExecutor node, you can just write your code. First, write your code like this:

```
import harkpython.harkbasenode as harkbasenode
class HarkNode (harkbasenode.HarkBaseNode):
    def __init__(self):
        # define the output names and types of your node as tuples here.
    def calculate(self):
        # write your code here.
```

Then, build a network that uses your code.

CHAPTER

THREE

INSTALLATION

1. Add HARK repository and install Basic HARK Packages. See HARK installation instructions for details.
2. Install HARK-Python

```
sudo apt-get install hark-python
```

CHAPTER

FOUR

GETTING STARTED

Tutorial 1: Run examples

Run the following shell script

```
/usr/share/doc/hark-python/run_examples.sh
```

Then, you will see instructions like this:

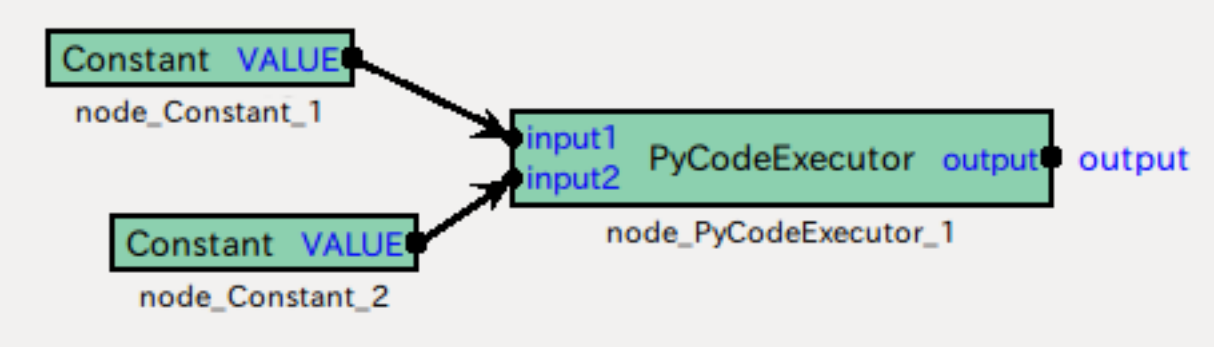
```
set the path first:
PYTHONPATH=$PYTHONPATH:/usr/share/doc/hark-python/examples

Plot localization result
/usr/share/doc/hark-python/examples/plotSourceNetwork.n \
   /usr/share/doc/hark-python/examples/plotSourceExample.dat

Plot spectrogram
/usr/share/doc/hark-python/examples/plotSpecNetwork.n \
   /usr/share/doc/hark-python/examples/longsample.wav

Plot waveform
/usr/share/doc/hark-python/examples/plotWaveformNetwork.n \
   /usr/share/doc/hark-python/examples/shortsample.wav
```

Following these instructions, set the environmental variable `PYTHONPATH` first, then, cut and paste the lines.

Tutorial 2: Implement your node with python

The goal is to calculate $input1^3 + input2^5$

1. Put two Constants and one PyCodeExecutor into your HARK network, and connect them, then, save as `tutorial1.n`.



2. Set parameters

1. Constant: int 3
2. Constant: int 5
3. PyCodeExecutor: default.

3. Write a code. save it as `samplecode.py` at the same path as the network file.

```
import harkpython.harkbasenode as harkbasenode

class HarkNode(harkbasenode.HarkBaseNode):
    def __init__(self):
        self.outputNames=("output",)  # one output terminal named "output"
        self.outputTypes=("prim_float",)  # the type is primitive float.

    def calculate(self):
        self.outputValues["output"] = self.input1 ** 3 + self.input2 ** 5
        # set output value
        # from two inputs: input1 and input2.
```

4. Run

```
./tutorial1.n
```

Tutorial 3: Simple container examples

[TODO] Use Vector, Matrix, and Map.

CHAPTER

FIVE

DESCRIPTION

harkbasenode

`harkbasenode` is a base class for HARK Python that interfaces the python code and HARK processing. To write a code for HARK Python, you MUST inherit the `harkbasenode` class.

For details, see `/usr/share/doc/hark-python/harkbasenode.html` or in python interpreter, run

```
import harkpython.harkbasenode
help(harkpython.harkbasenode)
```

Support types

Primitives int, float, complex<float>, and ObjectRef (= Source)

Containers Vector<T> [T = int, float, complex<float>, and Source] Matrix<T> [T = int, float, complex<float>] Map<int, T> [T = Vector<int>, Vector<float>, Vector<complex<float> >, Float, Matrix<int>, Matrix<float>, Matrix<complex<float> >]

Instance variables

self.nodeName The name of the node. e.g., node_PyCodeExecutor_1.

self.nodeID The ID of the node. if the node name is node_PyCodeExecutor_1, the ID is 1.

self.count The number of iterations.

If you want to plot the data for every 100 frames,

```
if self.count % 100 == 0
    pylab.plot(data)
    pylab.draw()
```

Parameters of PyCodeExecuter and how they are used

DIRECTORY_NAME This path is added to python path.

FILENAME The file name of your code. No extensions.

CLASSNAME The class name in your code that will be instanciated.

Equivalent code is:

```
import sys
sys.path.append(DIRECTORY_NAME)
import FILENAME
object = FILENAME.CLASSNAME()

# For each iteration, calculate() is called
object.calculate()
```

CHAPTER

SIX

TIPS

Can I add a parameter to the script?

Currently, PyCodeExecutor does not pass the given parameters to the scripts. Instead, since PyCodeExecutor can receive an arbitrary number of inputs, you can realize this using a Constant node.

For example, if you want to add a `subnet_param` named THRESHOLD to your PyCodeExecutor,

1. Add THRESHOLD input to PyCodeExecutor.
2. Add Constant node and connect its output to THRESHOLD.
3. Change the type of the VALUE of the Constant node to `subnet_param`.

Can I improve the calculation speed?

Some tips exist to improve processing speed.

1. Use python packages to increase speed: For example, using `numpy` or `scipy` will improve the scientific computation including matrix calculation, `cython` for using C functions, or `scipy.weave` for embedding C++ code into your python code.
2. skip calculation For example, plotting is too heavy to execute at every frame (i.e., 10 msec for default setting). In that case, you can use an instance variable `self.count` to execute the function at a regular interval.

   Here is an example code:

```
def calculate(self):
  if not self.count % 100 == 0:
    break

  # do some heavy_calculation
```

However, if the requirement of calculation speed is really high, you should use HARK-Python only for prototyping, and write the code in C++, which is the standard way in HARK.

I want to see other python code examples

HARK Python includes some examples as described in tutorial 1. The python codes are installed in `/usr/lib/python2.7/dist-packages/harkpython`.

CHAPTER

SEVEN

INDICES AND TABLES

- genindex
- modindex
- search