unPython

Compiling Python numerical programs to C

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Parallel Annotations
- NumPy
- Python

My Dream Project

unPython

GPU Code

OpenMP + C

C compiler

Multicore CPU

GPU

Disk

Disk
Parallel Annotations

NumPy
Python

unPython

OpenMP + C

C compiler

Multicore CPU

Currently working
Features

- Type signatures added as decorators
- Local variable types are inferred
- NumPy arrays are supported
- Parallel loops are supported
- Basic support for classes, tuples, lists, dicts
- Disclaimer: Talking about non-public version
Example

```python
import unpython

@unpython.type('int','int','int')
def f(x,y):
    temp = x + y
    return temp

Compilation:
python frontend.py mymodule.py
```
import unpython

@unpython.type('int','int','int')
def f(x,y):
    temp = x + y
    return temp

Compilation:
python frontend.py mymodule.py
Type examples

- 'ndarray[int 2]'  
- 'list[float]'  
- 'tuple[double]'  
- 'dict[int float]'  
- 'SomeClass'
Parallel Loops

for i in xrange(n): x[i] = x[i]*2.0

for i in unpython.range(n): x[i] = x[i]*2.0

#pragma omp parallel for
for(i=0;i<n;i++) x[i] = x[i]*2.0
Speedups on Quad-core

Code compiled using unPython

Speedups

<table>
<thead>
<tr>
<th>Matrix sizes</th>
<th>1 thread</th>
<th>2 threads</th>
<th>3 threads</th>
<th>4 threads</th>
</tr>
</thead>
<tbody>
<tr>
<td>512</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>768</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1024</td>
<td></td>
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</tr>
</tbody>
</table>

Legend:
- 1 thread
- 2 threads
- 3 threads
- 4 threads
Future Work

- Broader NumPy support
- Exceptions
- Ctypes
- Research: Better compiler internals
  - Alias analysis and Dependence analysis
- Research: More parallel programming
  - Broader parallel loop support
  - GPU Programming
  - Multicore optimizations
Help !!

- [http://code.google.com/p/unpython](http://code.google.com/p/unpython)
- License : GPLv3
- I need community support :
  - Submit bug reports
  - Test cases
  - Feature requests
  - Flames, comments, compiler crashes, questions ..
- Next release : August 30 2008
  - Will have everything we talked about and more
  - Requirements : Python 2.5, Numpy 1.0.4+, Java 5 or Java 6