cbenchmark_sum_type

June 30, 2023

1 Measures a vector sum with different accumulator type

This notebook compares how fast is the sum if the accumulator used to store the sum is of a different type than the summed elements.

[1]:
```
from jyquickhelper import add_notebook_menu
add_notebook_menu()
```

[1]:
```
<IPython.core.display.HTML object>
```

[2]:
```
%matplotlib inline
```

numpy is multithreaded. For an accurate comparison, this needs to be disabled. This can be done as follows or by setting environment variable `MKL_NUM_THREADS=1`.

[3]:
```
try:
    import mkl
    mkl.set_num_threads(1)
except ModuleNotFoundError as e:
    print('mkl not found', e)
    import os
    os.environ['MKL_NUM_THREADS']='1'
```

1.1 First comparison

We compare the two following implementation.

[4]:
```
# float scenario_Float(const float *p1, size_t size)
# {
#     float sum = 0;
#     const float * end1 = p1 + size;
#     for(; p1 != end1; ++p1)
#         sum += *p1;
#     return sum;
# }
#
# float scenario_Double(const float *p1, size_t size)
# {
#     double sum = 0;
#     const float * end1 = p1 + size;
#     for(; p1 != end1; ++p1)
#         sum += *p1;
#     return (float)sum;
```

```
# }
```

The third line is also repeated 10 times to avoid the loop being too significant.

[5]:
```
from cpyquickhelper.numbers.cbenchmark_sum_type import measure_scenario_Double,␣
↪measure_scenario_Float
```

[6]:
```
import pandas
import numpy

def test_benchmark(label, values, repeat=100, number=100):
    funcs = [(k, v) for k, v in globals().copy().items() if k.
↪startswith("measure_scenario")]
    rows = []
    for k, v in funcs:
        exe = v(values, repeat, number)
        d = exe.todict()
        d['doc'] = " ".join(v.__doc__.split('ExecutionStat')[1].strip().split(' ')[-3:
↪]).strip('.')
        d['label'] = label
        d['name'] = k.replace("measure_", "")
        rows.append(d)
    df = pandas.DataFrame(rows)
    return df

test_benchmark("sorted", numpy.random.rand(10).astype(numpy.float32))
```

[6]:
```
        average     deviation                   doc   label      max_exec  \
0  7.664200e-09  7.683250e-08  a double accumulator  sorted  7.910000e-07
1  5.096300e-09  5.378331e-08   a float accumulator  sorted  7.910000e-07

       min_exec             name  number  repeat
0  3.950000e-07  scenario_Double   100.0   100.0
1  3.950000e-07   scenario_Float   100.0   100.0
```

Times are not very conclusive on such small lists.

[7]:
```
values = numpy.random.rand(100000).astype(numpy.float32)

df = test_benchmark("sorted", values)
df
```

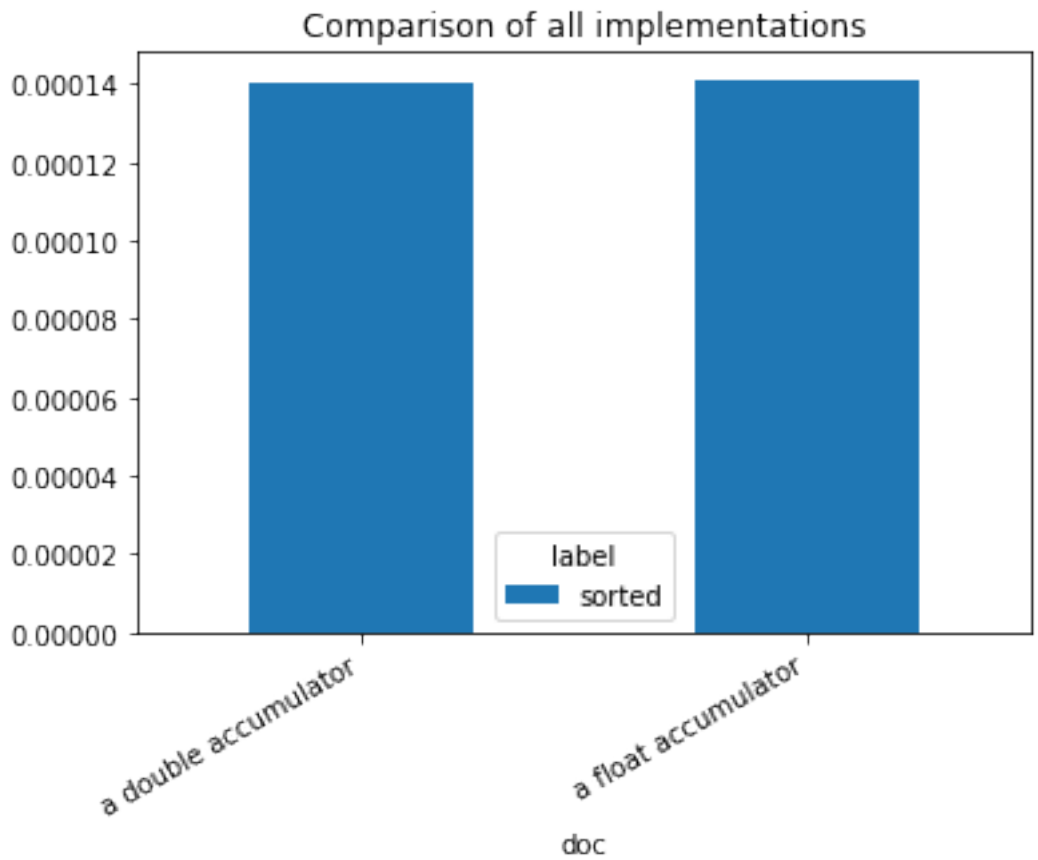
[7]:
```
    average  deviation                   doc   label  max_exec  min_exec  \
0  0.000140    0.00143  a double accumulator  sorted  0.042079  0.013098
1  0.000141    0.00143   a float accumulator  sorted  0.037468  0.013094

              name  number  repeat
0  scenario_Double   100.0   100.0
1   scenario_Float   100.0   100.0
```

[8]:
```
df = pandas.concat([df])
dfg = df[["doc", "label", "average"]].pivot("doc", "label", "average")
```

[9]:
```
ax = dfg.plot.bar(rot=30)
labels = [l.get_text() for l in ax.get_xticklabels()]
```

```
ax.set_xticklabels(labels, ha='right')
ax.set_title("Comparison of all implementations");
```



1.2 For different sizes

[10]:
```
dfs = []

for i in range(2, 7):
    n = 10 ** i
    values = numpy.random.rand(n).astype(numpy.float32)
    df = test_benchmark("sorted", values, repeat=20)
    df["size"] = float(n)
    dfs.append(df)

df = pandas.concat(dfs)
df.head()
```

[10]:
```
         average  deviation                   doc   label  max_exec  min_exec  \
0  1.418275e-07   0.000001  a double accumulator  sorted  0.000026  0.000013
1  1.590125e-07   0.000002   a float accumulator  sorted  0.000043  0.000012
0  1.380739e-06   0.000014  a double accumulator  sorted  0.000190  0.000127
1  1.292245e-06   0.000013   a float accumulator  sorted  0.000161  0.000124
```

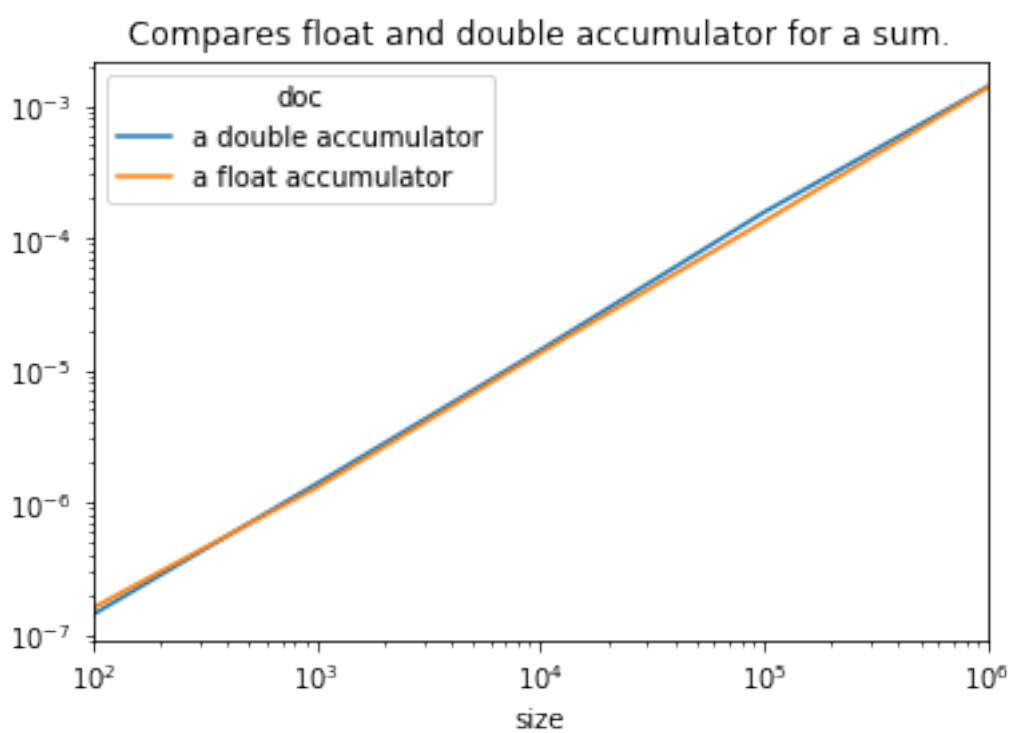
```
0  1.415682e-05   0.000142  a double accumulator  sorted  0.001969  0.001293

              name  number  repeat     size
0  scenario_Double   100.0    20.0    100.0
1   scenario_Float   100.0    20.0    100.0
0  scenario_Double   100.0    20.0   1000.0
1   scenario_Float   100.0    20.0   1000.0
0  scenario_Double   100.0    20.0  10000.0
```

[11]:
```
piv = df.pivot("size", "doc", "average")
cols = piv.columns
piv = piv.reset_index(drop=False)
piv["ratio"] = piv["a double accumulator"] / piv["a float accumulator"]
piv
```

[11]:
```
doc       size  a double accumulator  a float accumulator     ratio
0        100.0          1.418275e-07         1.590125e-07  0.891927
1       1000.0          1.380739e-06         1.292245e-06  1.068480
2      10000.0          1.415682e-05         1.347988e-05  1.050218
3     100000.0          1.558953e-04         1.326750e-04  1.175017
4    1000000.0          1.391328e-03         1.367595e-03  1.017354
```

[12]:
```
ax = piv.plot(x='size', y=cols, logy=True, logx=True)
ax.set_title("Compares float and double accumulator for a sum.");
```



There is almost no difference.

[13]:

```

```