analysis

October 17, 2021

1 Log Parsing Benchmark Analysis

All log parsing algorithms were run 6 times each on a 12-core Intel Core i7-9750H CPU with 16GB of RAM running Pop_OS! 21.04.

[ ]:
```
import os
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import re
```

1.1 Time Analysis

[ ]:
```
time_df = pd.DataFrame(columns=["algo", "dataset", "time"])
time_regex = r"(?<=Parsing done. \[Time taken: )\d:\d+:\d+.\d+"
time_regex_fallback = r"(?<=Parsing done. \[Time: )\d:\d+:\d+.\d+"

for filename in sorted(os.listdir("outputs")):
    [algo, iteration] = filename.split("_")
    with open("outputs/" + filename, "r") as f:
        times = re.findall(time_regex, f.read())
    if len(times) == 0:
        with open("outputs/" + filename, "r") as f:
            times = re.findall(time_regex_fallback, f.read())
    time_df = time_df.append(
        {
            "algo": algo,
            "dataset": "HDFS",
            "time": pd.Timedelta(times[0]).total_seconds(),
        },
        ignore_index=True,
    )
    time_df = time_df.append(
        {
            "algo": algo,
            "dataset": "BGL",
            "time": pd.Timedelta(times[1]).total_seconds(),
        },
        ignore_index=True,
    )

time_df
```

[ ]:

```
      algo dataset      time
0      AEL    HDFS  0.362798
1      AEL     BGL  0.270329
2      AEL    HDFS  0.285344
3      AEL     BGL  0.275296
4      AEL    HDFS  0.298853
..     …       …         …
151  Spell     BGL  0.655828
152  Spell    HDFS  0.398777
153  Spell     BGL  0.665933
154  Spell    HDFS  0.391038
155  Spell     BGL  0.660896

[156 rows x 3 columns]
```

[ ]:

```
avg_time_df = (
    time_df.groupby(["algo", "dataset"]).mean(numeric_only=False).reset_index()
)
avg_time_df
```

[ ]:

```
          algo dataset        time
0          AEL     BGL    0.265144
1          AEL    HDFS    0.303317
2        Drain     BGL    0.340670
3        Drain    HDFS    0.375423
4        IPLoM     BGL    0.302273
5        IPLoM    HDFS    0.305821
6          LFA     BGL    0.187106
7          LFA    HDFS    0.210758
8          LKE     BGL   57.855254
9          LKE    HDFS   54.928430
10       Lenma     BGL    2.359167
11       Lenma    HDFS    0.440831
12  LogCluster     BGL    0.203864
13  LogCluster    HDFS    0.196447
14     LogMine     BGL    3.815657
15     LogMine    HDFS    6.311744
16      LogSig     BGL  129.497067
17      LogSig    HDFS    2.398137
18       MoLFI     BGL   26.258781
19       MoLFI    HDFS    3.910462
20       SHISO     BGL    4.869288
```

```
21       SHISO    HDFS    1.304586
22        SLCT     BGL    1.299598
23        SLCT    HDFS    0.675247
24       Spell     BGL    0.663679
25       Spell    HDFS    0.395011
```

1.2 F1-measure and Accuracy Analysis

```
[ ]: results_df = pd.DataFrame(columns=["algo", "dataset", "f1_measure", "accuracy"])

     for filename in sorted(os.listdir("results")):
         algo = filename.split("_")[0]
         with open("results/" + filename, "r") as f:
             lines = f.readlines()
             lines = [line.strip() for line in lines]
             results_df = results_df.append(
                 {
                     "algo": algo,
                     "dataset": "HDFS",
                     "f1_measure": float(lines[1].split(",")[1]),
                     "accuracy": float(lines[2].split(",")[1]),
                 },
                 ignore_index=True,
             )
             results_df = results_df.append(
                 {
                     "algo": algo,
                     "dataset": "BGL",
                     "f1_measure": float(lines[1].split(",")[2]),
                     "accuracy": float(lines[2].split(",")[2]),
                 },
                 ignore_index=True,
             )

     results_df
```

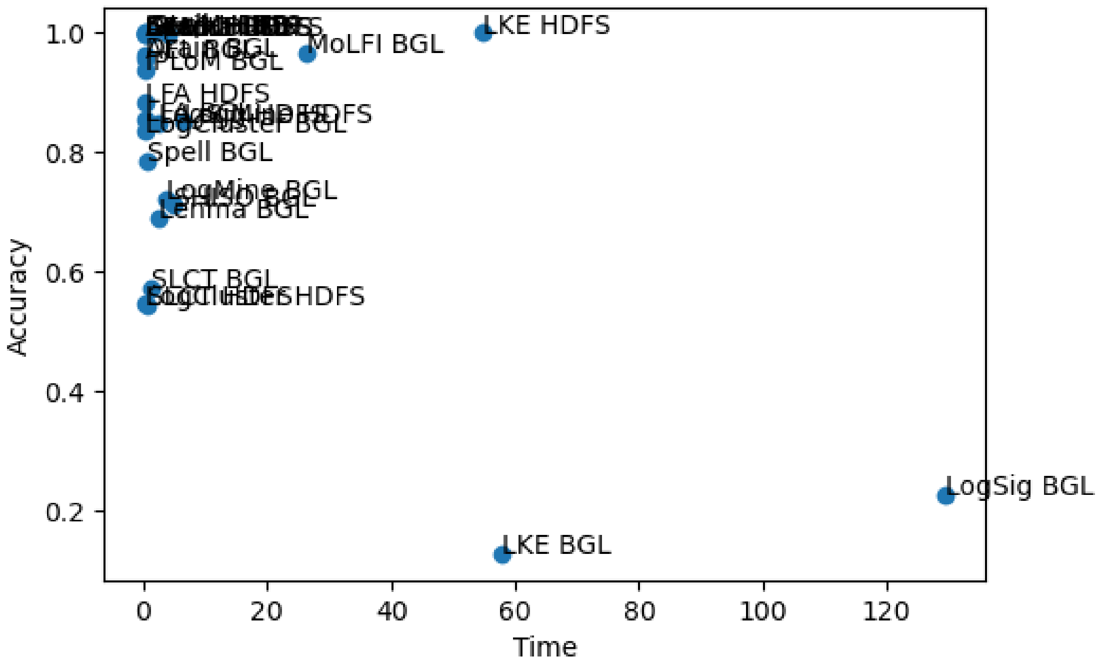
```
[ ]:           algo dataset  f1_measure  accuracy
     0          AEL    HDFS    0.999984    0.9975
     1          AEL     BGL    0.999554    0.9570
     2        Drain    HDFS    0.999984    0.9975
     3        Drain     BGL    0.999599    0.9625
     4        IPLoM    HDFS    1.000000    1.0000
     5        IPLoM     BGL    0.999110    0.9390
     6          LFA    HDFS    0.999545    0.8850
     7          LFA     BGL    0.997902    0.8540
     8          LKE    HDFS    1.000000    1.0000
     9          LKE     BGL    0.399353    0.1275
```

```
10        Lenma    HDFS    0.999984    0.9975
11        Lenma     BGL    0.939369    0.6895
12   LogCluster    HDFS    0.951863    0.5460
13   LogCluster     BGL    0.996965    0.8350
14      LogMine    HDFS    0.998840    0.8505
15      LogMine     BGL    0.971268    0.7230
16       LogSig    HDFS    0.991767    0.8495
17       LogSig     BGL    0.934917    0.2265
18        MoLFI    HDFS    0.999984    0.9975
19        MoLFI     BGL    0.999778    0.9660
20       SHISO    HDFS    0.999984    0.9975
21       SHISO     BGL    0.994450    0.7110
22        SLCT    HDFS    0.965812    0.5450
23        SLCT     BGL    0.955247    0.5725
24       Spell    HDFS    1.000000    1.0000
25       Spell     BGL    0.956932    0.7865
```

```
[ ]: final_df = results_df.merge(avg_time_df, on=["algo", "dataset"])
     final_df
```

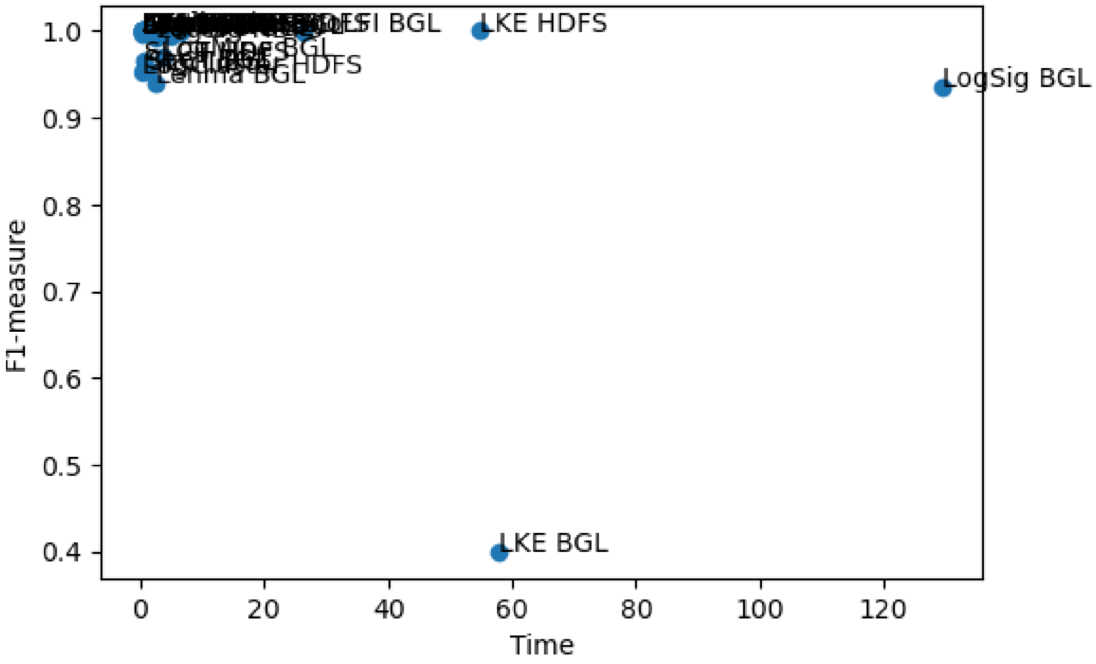
```
[ ]:          algo dataset  f1_measure  accuracy        time
     0         AEL    HDFS    0.999984    0.9975    0.303317
     1         AEL     BGL    0.999554    0.9570    0.265144
     2       Drain    HDFS    0.999984    0.9975    0.375423
     3       Drain     BGL    0.999599    0.9625    0.340670
     4       IPLoM    HDFS    1.000000    1.0000    0.305821
     5       IPLoM     BGL    0.999110    0.9390    0.302273
     6         LFA    HDFS    0.999545    0.8850    0.210758
     7         LFA     BGL    0.997902    0.8540    0.187106
     8         LKE    HDFS    1.000000    1.0000   54.928430
     9         LKE     BGL    0.399353    0.1275   57.855254
     10      Lenma    HDFS    0.999984    0.9975    0.440831
     11      Lenma     BGL    0.939369    0.6895    2.359167
     12 LogCluster    HDFS    0.951863    0.5460    0.196447
     13 LogCluster     BGL    0.996965    0.8350    0.203864
     14    LogMine    HDFS    0.998840    0.8505    6.311744
     15    LogMine     BGL    0.971268    0.7230    3.815657
     16     LogSig    HDFS    0.991767    0.8495    2.398137
     17     LogSig     BGL    0.934917    0.2265  129.497067
     18      MoLFI    HDFS    0.999984    0.9975    3.910462
     19      MoLFI     BGL    0.999778    0.9660   26.258781
     20      SHISO    HDFS    0.999984    0.9975    1.304586
     21      SHISO     BGL    0.994450    0.7110    4.869288
     22       SLCT    HDFS    0.965812    0.5450    0.675247
     23       SLCT     BGL    0.955247    0.5725    1.299598
     24      Spell    HDFS    1.000000    1.0000    0.395011
     25      Spell     BGL    0.956932    0.7865    0.663679
```

```
[ ]: plt.figure(dpi=100)
     plt.scatter(final_df["time"], final_df["accuracy"])
     plt.xlabel("Time")
     plt.ylabel("Accuracy")
     for i, row in final_df.iterrows():
         plt.annotate(f"{row['algo']} {row['dataset']}", (row["time"],␣
      ↪row["accuracy"]))
```



Most algorithms are fast, although they have varying accuracies. LKE and LogSig are clear outliers, due to a longer execution time.

```
[ ]: plt.figure(dpi=100)
     plt.scatter(final_df["time"], final_df["f1_measure"])
     plt.xlabel("Time")
     plt.ylabel("F1-measure")
     for i, row in final_df.iterrows():
         plt.annotate(f"{row['algo']} {row['dataset']}", (row["time"],␣
      ↪row["f1_measure"]))
```

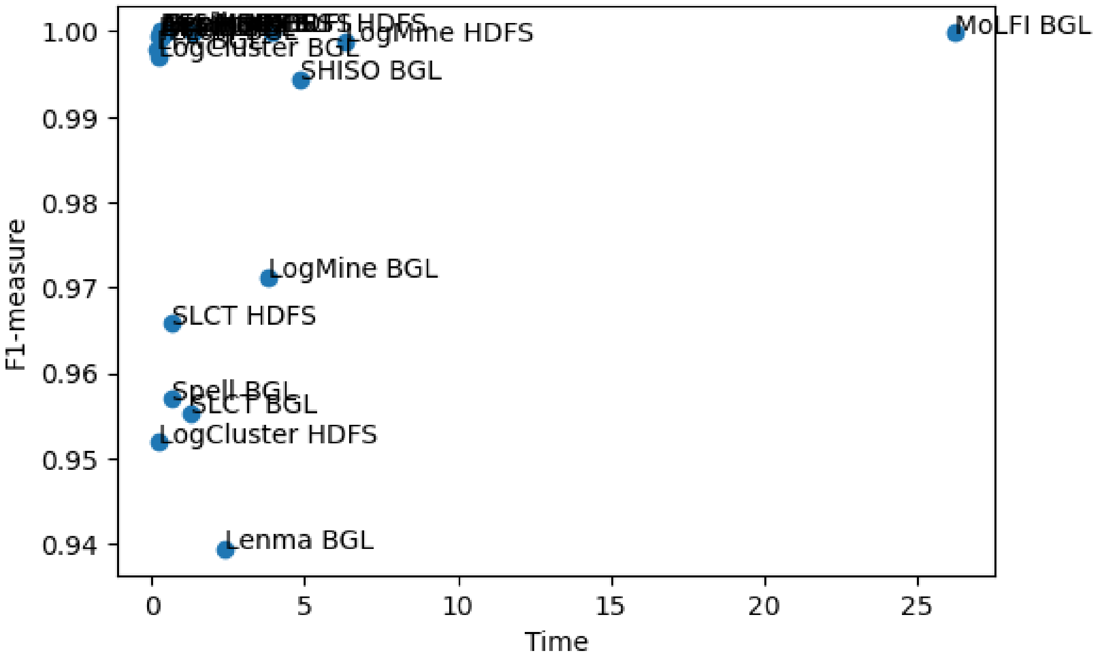


We can notice that LKE and LogSig are also outliers in terms of F1-measure over time. These algorithms are not efficient.

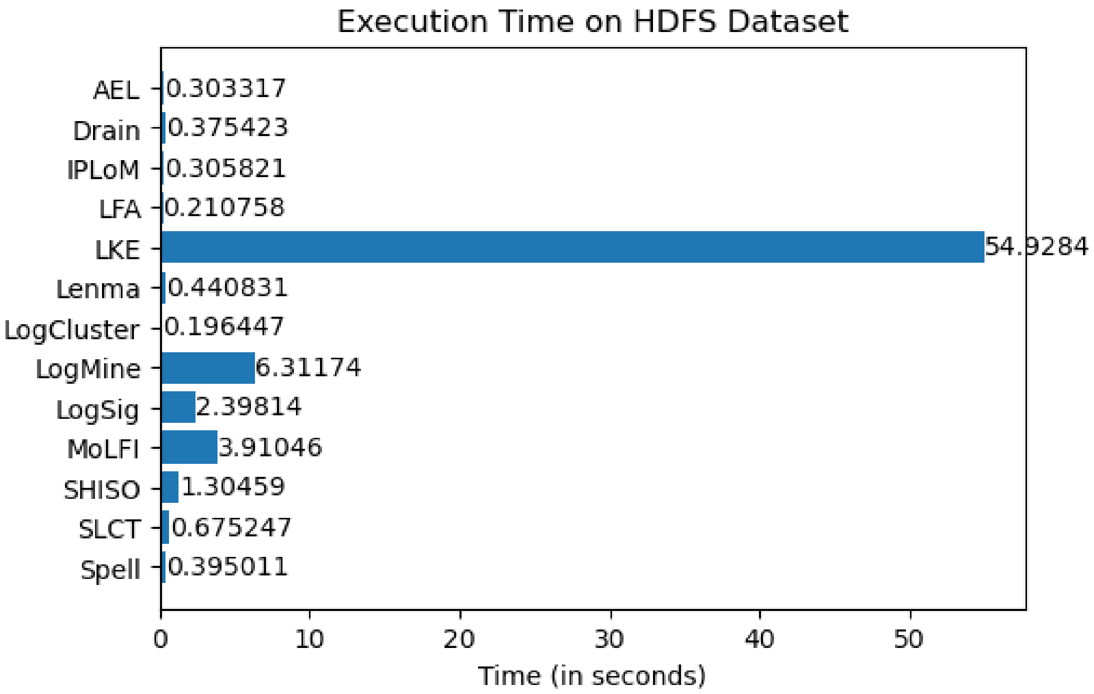
Removing them yields the following graph:

[ ]:

```
filtered_final_df = final_df[(final_df.algo != "LKE") & (final_df.algo !=␣
 ↪"LogSig")]

plt.figure(dpi=100)
plt.scatter(filtered_final_df["time"], filtered_final_df["f1_measure"])
plt.xlabel("Time")
plt.ylabel("F1-measure")
for i, row in filtered_final_df.iterrows():
    plt.annotate(f"{row['algo']} {row['dataset']}", (row["time"],␣
 ↪row["f1_measure"]))
```

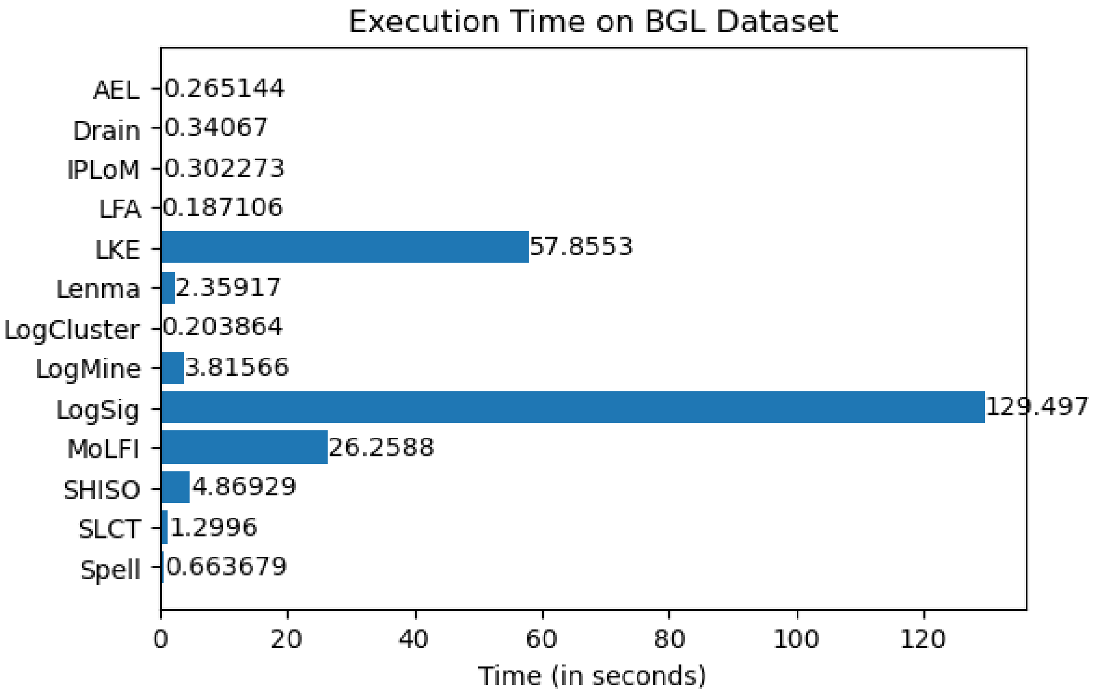


[ ]:
```
fig, ax = plt.subplots()

hdfs_df = final_df[final_df.dataset == "HDFS"]
bgl_df = final_df[final_df.dataset == "BGL"]

plt.barh(hdfs_df["algo"], hdfs_df["time"])
ax.invert_yaxis()
ax.set_xlabel("Time (in seconds)")
ax.set_title("Execution Time on HDFS Dataset")
ax.bar_label(ax.containers[0])
fig.set_dpi(100)
plt.show()
```



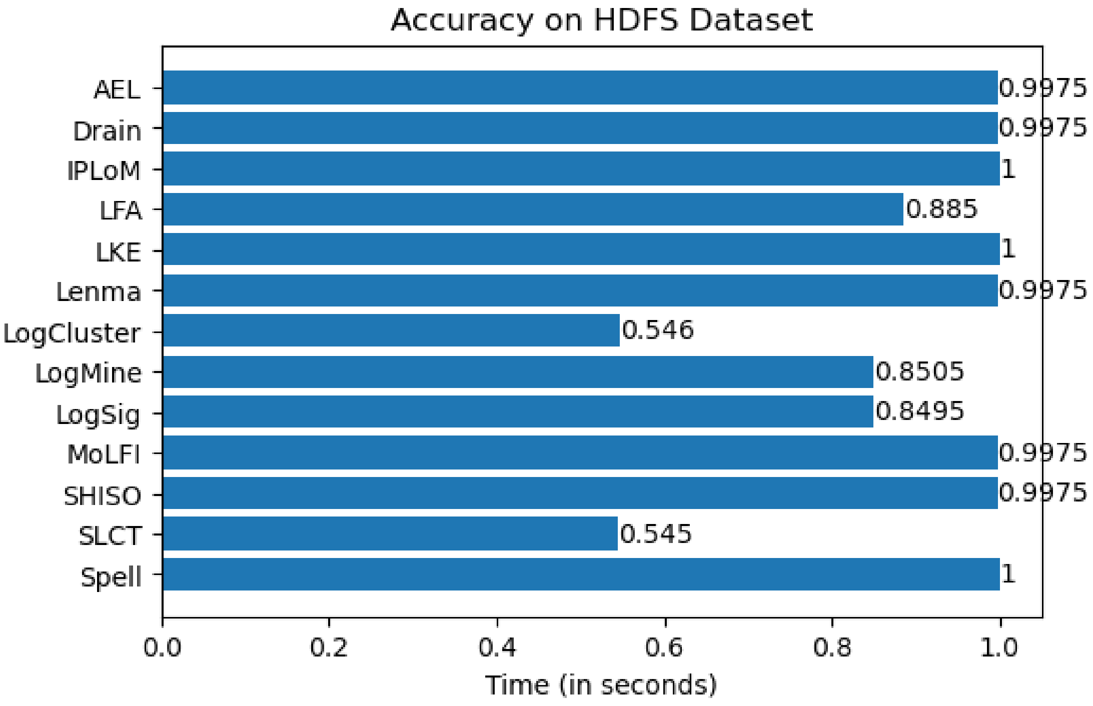
[ ]:

```
fig, ax = plt.subplots()

plt.barh(bgl_df["algo"], bgl_df["time"])
ax.invert_yaxis()
ax.set_xlabel("Time (in seconds)")
ax.set_title("Execution Time on BGL Dataset")
ax.bar_label(ax.containers[0])
fig.set_dpi(100)
plt.show()
```



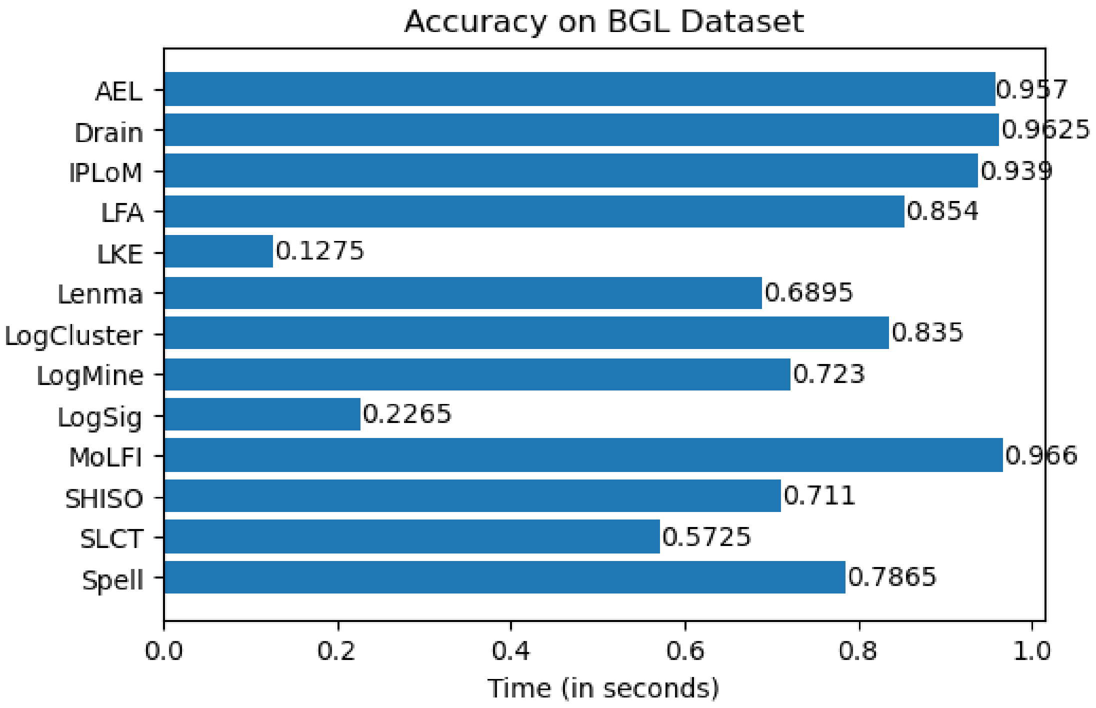
[ ]:

```
fig, ax = plt.subplots()

plt.barh(hdfs_df["algo"], hdfs_df["accuracy"])
ax.invert_yaxis()
ax.set_xlabel("Time (in seconds)")
ax.set_title("Accuracy on HDFS Dataset")
ax.bar_label(ax.containers[0])
fig.set_dpi(100)
plt.show()
```



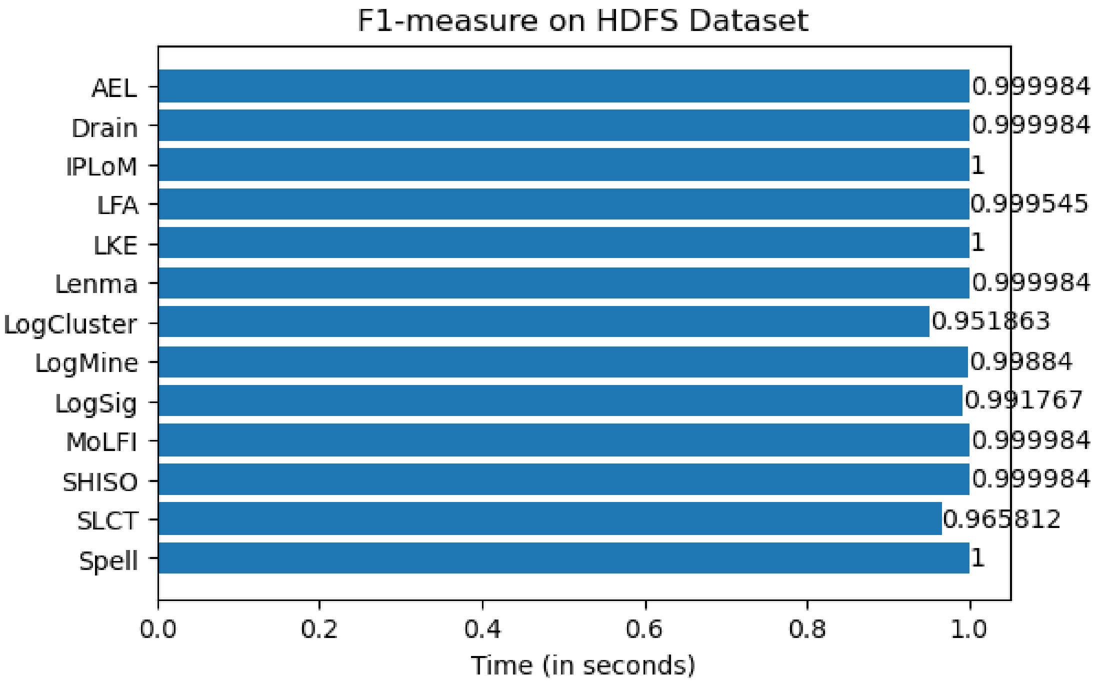
[ ]:

```
fig, ax = plt.subplots()

plt.barh(bgl_df["algo"], bgl_df["accuracy"])
ax.invert_yaxis()
ax.set_xlabel("Time (in seconds)")
ax.set_title("Accuracy on BGL Dataset")
ax.bar_label(ax.containers[0])
fig.set_dpi(100)
plt.show()
```



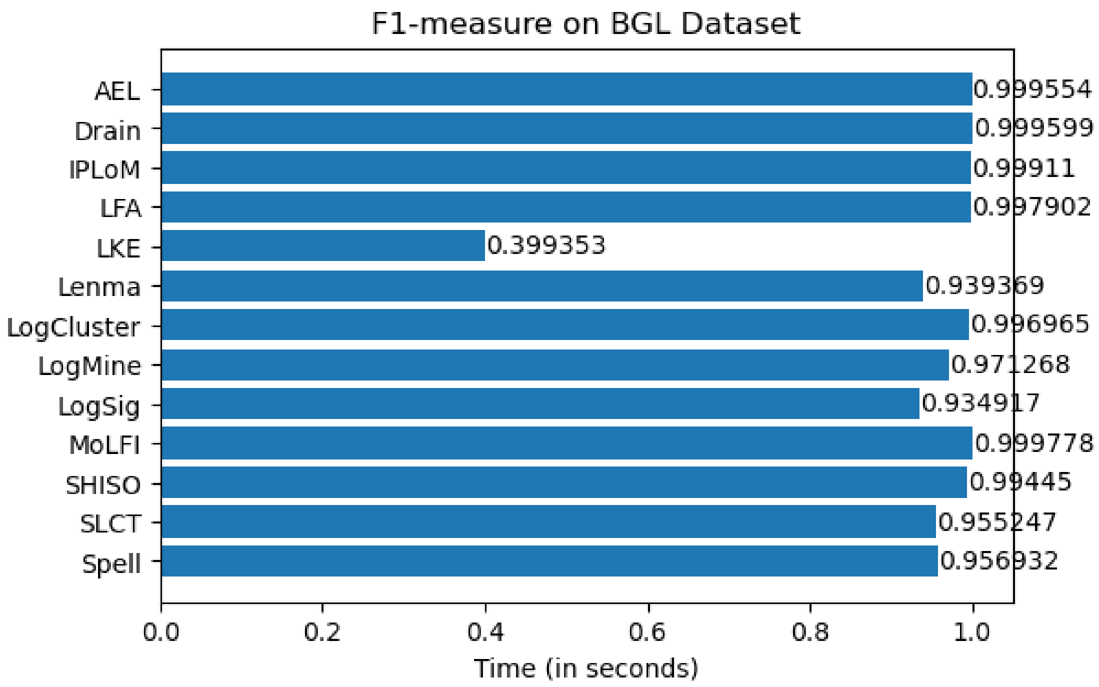
[ ]:

```
fig, ax = plt.subplots()

plt.barh(hdfs_df["algo"], hdfs_df["f1_measure"])
ax.invert_yaxis()
ax.set_xlabel("Time (in seconds)")
ax.set_title("F1-measure on HDFS Dataset")
ax.bar_label(ax.containers[0])
fig.set_dpi(100)
plt.show()
```



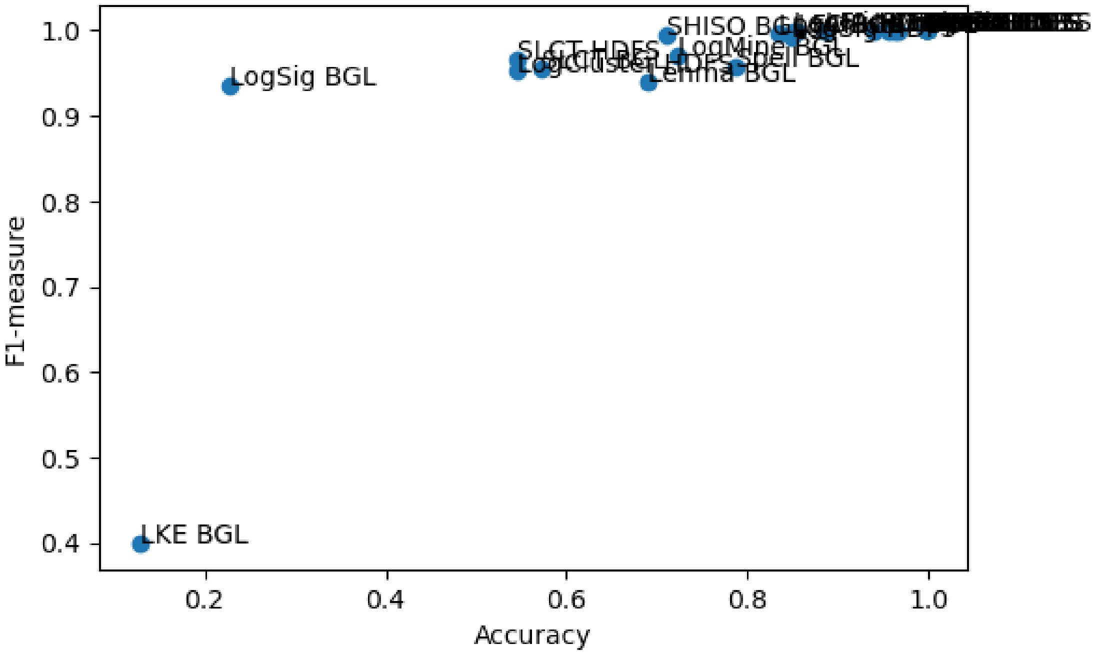
[ ]:

```
fig, ax = plt.subplots()

plt.barh(bgl_df["algo"], bgl_df["f1_measure"])
ax.invert_yaxis()
ax.set_xlabel("Time (in seconds)")
ax.set_title("F1-measure on BGL Dataset")
ax.bar_label(ax.containers[0])
fig.set_dpi(100)
plt.show()
```

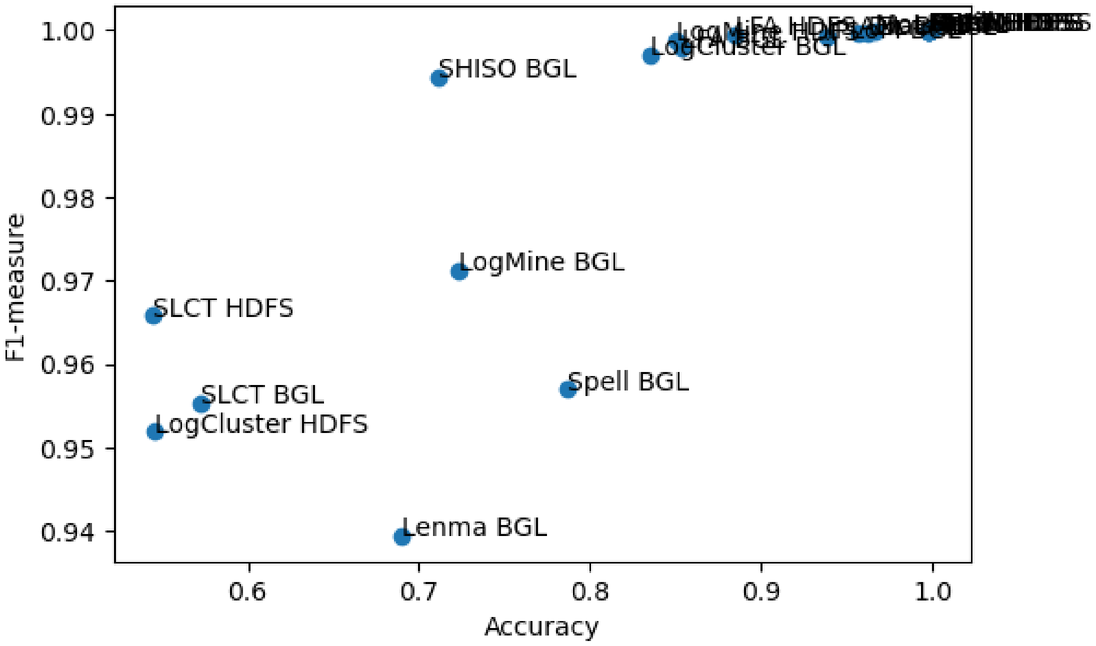


[ ]:

```
plt.figure(dpi=100)
plt.scatter(final_df["accuracy"], final_df["f1_measure"])
plt.xlabel("Accuracy")
plt.ylabel("F1-measure")
for i, row in final_df.iterrows():
    plt.annotate(
        f"{row['algo']} {row['dataset']}", (row["accuracy"], row["f1_measure"])
    )
```



```
[ ]: plt.figure(dpi=100)
     plt.scatter(filtered_final_df["accuracy"], filtered_final_df["f1_measure"])
     plt.xlabel("Accuracy")
     plt.ylabel("F1-measure")
     for i, row in filtered_final_df.iterrows():
         plt.annotate(
             f"{row['algo']} {row['dataset']}", (row["accuracy"], row["f1_measure"])
         )
```


1.00
0.99
0.98
0.97
0.96
0.95
0.94
F1-measure
0.6
0.7
0.8
0.9
1.0
Accuracy
LogMine HDFS
LiFA HDFS
LogCluster BGL
SHISO BGL
LogMine BGL
SLCT HDFS
Spell BGL
SLCT BGL
LogCluster HDFS
Lenma BGL