

## Hadoop ile Patent Verisi Islemek

75-99 yillari arasinda hangi patentin hangi hangi patentlere referans verdigi ve patentler hakkında detayli verileri Hadoop ile isleyecegiz. Veriler alttaki baglantidan alinabilir, gerekli dosyalar Dosyalar cite75\_99.txt ve apat63\_99.txt. Bu dosyalari acip biz \$HOME/Downloads altina koyduk.

<http://www.nber.org/patents/>

Referans verisine bakarsak,

```
!head -10 $HOME/Downloads/cite75_99.txt
```

```
"CITING","CITED"  
3858241,956203  
3858241,1324234  
3858241,3398406  
3858241,3557384  
3858241,3634889  
3858242,1515701  
3858242,3319261  
3858242,3668705  
3858242,3707004
```

Bu veri, hangi patentin hangi diger patenti kullandigini “tek” patent bazinda gostermekte. Detayli patent verisine bakalim

```
!head -10 $HOME/Downloads/apat63_99.txt
```

```
"PATENT","GYEAR","GDATE","APPYEAR","COUNTRY","POSTATE","ASSIGNEE","ASSCODE","CLAIMS","NCLASS","CAT","SU  
3070801,1963,1096,,,"BE",,,1,,269,6,69,,1,,0,,,,,  
3070802,1963,1096,,,"US","TX",,1,,2,6,63,,0,,,,,  
3070803,1963,1096,,,"US","IL",,1,,2,6,63,,9,,0.3704,,,,,  
3070804,1963,1096,,,"US","OH",,1,,2,6,63,,3,,0.6667,,,,,  
3070805,1963,1096,,,"US","CA",,1,,2,6,63,,1,,0,,,,,  
3070806,1963,1096,,,"US","PA",,1,,2,6,63,,0,,,,,  
3070807,1963,1096,,,"US","OH",,1,,623,3,39,,3,,0.4444,,,,,  
3070808,1963,1096,,,"US","IA",,1,,623,3,39,,4,,0.375,,,,,  
3070809,1963,1096,,,"US","AZ",,1,,4,6,65,,0,,,,,
```

Simdi patent detay verisinden bir orneklem (sample) alalim. Daha ufak bir veri kumesiyle calismak ilk basta faydali olabilir, gelistirme test etme surecini hizlandirir.

```
!chmod a+r $HOME/Downloads/apat63_99.txt  
!head -1 $HOME/Downloads/apat63_99.txt > $HOME/Downloads/apat63_99_sampled.txt  
!cat $HOME/Downloads/apat63_99.txt | perl -n -e 'print if (rand() < .05)' >> $HOME/  
Downloads/apat63_99_sampled.txt
```

Hadoop baslatalim

```
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/stop-all.sh
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/start-all.sh
```

no jobtracker to stop

localhost: no tasktracker to stop

no namenode to stop

localhost: no datanode to stop

localhost: no secondarynamenode to stop

starting namenode, logging to /home/hduser/Downloads/hadoop-1.0.4/libexec/../../logs/hadoop-hduser-namenode

localhost: starting datanode, logging to /home/hduser/Downloads/hadoop-1.0.4/libexec/../../logs/hadoop-hduser

localhost: starting secondarynamenode, logging to /home/hduser/Downloads/hadoop-1.0.4/libexec/../../logs/hadoop-hduser

starting jobtracker, logging to /home/hduser/Downloads/hadoop-1.0.4/libexec/../../logs/hadoop-hduser-jobtra

localhost: starting tasktracker, logging to /home/hduser/Downloads/hadoop-1.0.4/libexec/../../logs/hadoop-h

```
/home/hduser/Downloads/hadoop*/bin/hadoop dfs -mkdir /user/hduser/patent
```

```
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop dfs -ls /user/hduser/
patent
```

Found 2 items

```
-rw-r--r--  1 hduser supergroup  236903179 2013-02-21 14:16 /user/hduser/patent/apat63_99.txt
-rw-r--r--  1 hduser supergroup   11878646 2013-02-21 16:36 /user/hduser/patent/apat63_99_sampled.txt
```

```
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop dfs -copyFromLocal
$HOME/Downloads/apat63_99_sampled.txt /user/hduser/patent/apat63_99_sampled.txt
```

copyFromLocal: Target /user/hduser/patent/apat63\_99\_sampled.txt already exists

Amacimiz patent verisindeki ulke (country) kodunu kullanarak her ulke basina ortalama ne kadar patent uretildigini hesaplamak. Esleme-Indirgeme (Map-Reduce) dongusunda esleme kismini yapacak program asagida.

```
print open("mapper.py").read()
```

```
#!/usr/bin/python
import os,sys
```

```
os.environ['MPLCONFIGDIR']=' /tmp'
import pandas as pd
data = pd.read_csv(sys.stdin,sep=",",index_col=0,usecols=[0,4,8])
df = data[pd.notnull(data.ix[:,0]) & pd.notnull(data.ix[:,1])].ix[:,0:2]
df.to_csv(sys.stdout,sep="\t",index=False,header=False)
```

Indirgeyici yazmadan once programimizi iki sekilde test edelim. Bu sekillerden birisi hic indirgeyici olmadan, ikincisi IdentityReducer denen kendisine gecilen veriyi oldugu gibi disari atan (ama yine de ortada bir indirgeyici oldugu icin sonradan bazi islemlerin yine de yapildigi) seklinde. Bu iki kullanim Hadoop kodlarinda hata bulma / temizleme icin faydali olabiliyor.

```
!cp mapper.py /tmp/
!chmod a+r /tmp/mapper.py
!chmod a+x /tmp/mapper.py
```

```
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop dfs -rmr /user/hduser/output
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop jar /home/hduser/Downloads/hadoop*/contrib/streaming/hadoop-*streaming*.jar -input patent/apat63_99_sampled.txt -output output -mapper /tmp/mapper.py -numReduceTasks 0
```

Deleted hdfs://localhost:54310/user/hduser/output

packageJobJar: [/app/hadoop/tmp/hadoop-unjar2555196345671652661/] [] /tmp/streamjob5013687273729997973.

```
13/02/24 16:30:26 INFO util.NativeCodeLoader: Loaded the native-hadoop library
13/02/24 16:30:26 WARN snappy.LoadSnappy: Snappy native library not loaded
13/02/24 16:30:26 INFO mapred.FileInputFormat: Total input paths to process : 1

13/02/24 16:30:27 INFO streaming.StreamJob: getLocalDirs(): [/app/hadoop/tmp/mapred/local]
13/02/24 16:30:27 INFO streaming.StreamJob: Running job: job_201302241611_0012
13/02/24 16:30:27 INFO streaming.StreamJob: To kill this job, run:
13/02/24 16:30:27 INFO streaming.StreamJob: /home/hduser/Downloads/hadoop-1.0.4/libexec/./bin/hadoop j
13/02/24 16:30:27 INFO streaming.StreamJob: Tracking URL: http://localhost:50030/jobdetails.jsp?jobid=j

13/02/24 16:30:28 INFO streaming.StreamJob: map 0% reduce 0%

13/02/24 16:30:43 INFO streaming.StreamJob: map 100% reduce 0%

13/02/24 16:30:49 INFO streaming.StreamJob: map 100% reduce 100%
13/02/24 16:30:49 INFO streaming.StreamJob: Job complete: job_201302241611_0012
13/02/24 16:30:49 INFO streaming.StreamJob: Output: output
```

```
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop dfs -copyToLocal output /tmp/
!head -20 /tmp/output/part-00000
```

```
AD 14.0
AE 15.4
AG 13.25
AI 10.0
AM 18.0
AN 9.625
AR 9.188990825688073
AT 10.683988393563704
AU 12.291563832174107
AW 15.5
AZ 11.0
BB 11.0
BE 11.945544554455445
BG 4.9899497487437188
BH 6.5
BM 10.076923076923077
BN 9.0
BO 11.75
BR 9.358426966292134
BS 15.778846153846153
```

Ustteki sonucta goruyoruz ki anahtarlar uretilmis, ama ciktilar anahtara gore siralanmamislar. Hatta ustteki sira girdi sirasiyla tipatip ayni. Simdi IdentityReducer uzerinden.

```
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop dfs -rmr /user/hduser
/output
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop jar /home/hduser/
Downloads/hadoop*/contrib/streaming/hadoop-*streaming*.jar -input patent/
apat63_99_sampled.txt -output output -mapper /tmp/mapper.py -reducer org.apache.
hadoop.mapred.lib.IdentityReducer -numReduceTasks 1
```

Deleted hdfs://localhost:54310/user/hduser/output

packageJobJar: [/app/hadoop/tmp/hadoop-unjar2314287838929839696/] [] /tmp/streamjob5231815242060775825.

```
13/02/24 18:03:14 INFO util.NativeCodeLoader: Loaded the native-hadoop library
13/02/24 18:03:14 WARN snappy.LoadSnappy: Snappy native library not loaded
13/02/24 18:03:14 INFO mapred.FileInputFormat: Total input paths to process : 1
```

```
13/02/24 18:03:14 INFO streaming.StreamJob: getLocalDirs(): [/app/hadoop/tmp/mapred/local]
13/02/24 18:03:14 INFO streaming.StreamJob: Running job: job_201302241759_0004
13/02/24 18:03:14 INFO streaming.StreamJob: To kill this job, run:
13/02/24 18:03:14 INFO streaming.StreamJob: /home/hduser/Downloads/hadoop-1.0.4/libexec/./bin/hadoop j
13/02/24 18:03:14 INFO streaming.StreamJob: Tracking URL: http://localhost:50030/jobdetails.jsp?jobid=j
```

```
13/02/24 18:03:15 INFO streaming.StreamJob: map 0% reduce 0%
```

```
13/02/24 18:03:28 INFO streaming.StreamJob: map 50% reduce 0%
```

```
13/02/24 18:03:31 INFO streaming.StreamJob: map 100% reduce 0%
13/02/24 18:03:40 INFO streaming.StreamJob: map 100% reduce 100%
13/02/24 18:03:46 INFO streaming.StreamJob: Job complete: job_201302241759_0004
13/02/24 18:03:46 INFO streaming.StreamJob: Output: output
```

```
!ssh localhost -l hduser rm -rf /tmp/output
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop dfs -copyToLocal
output /tmp/
!head -10 /tmp/output/part-00000
```

```
FR 12.0
US 5.0
US 1.0
US 4.0
US 4.0
US 21.0
US 4.0
US 8.0
US 7.0
US 11.0
```

Ustteki sonucta anahtarlarin siralanmis oldugunu goruyoruz.

Simdi bir indirgeyici (reducer) ekleyelim. Bu indirgeyici ulke bazindaki veriler uzerinen ortalama alacak.

```
print open("reducer.py").read()
```

```
#!/usr/bin/python
import os,sys
os.environ['MPLCONFIGDIR']= '/tmp'
import pandas as pd
data = pd.read_csv(sys.stdin,sep="\t",names=['country','count'])
grouped = data.groupby('country').mean()
grouped.to_csv(sys.stdout,sep="\t",header=False)
```

Eger indirgeyiciyi direk isletirsek (Hadoop disindan)

```
cat /tmp/output/part-00000 | ./reducer.py | tail -10
```

```
SE 9.0021739130434781
SG 14.0
SU 6.4136125654450264
SV 6.5
TR 8.0
```

```
TW 6.2037037037037033
US 10.964136780650541
VE 9.3333333333333339
YU 5.75
ZA 11.170212765957446
```

Bu kodu hduser'in bulabilecegi bir yere koyuyoruz.

```
!cp reducer.py /tmp/
!chmod a+r /tmp/reducer.py
!chmod a+x /tmp/reducer.py
```

```
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop dfs -rmr /user/hduser/
/output
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop jar /home/hduser/
Downloads/hadoop*/contrib/streaming/hadoop-*streaming*.jar -input patent/
apat63_99_sampled.txt -output output -mapper /tmp/mapper.py -reducer /tmp/reducer.py
-numReduceTasks 1
```

Deleted hdfs://localhost:54310/user/hduser/output

packageJobJar: [/app/hadoop/tmp/hadoop-unjar3358838375062006941/] [] /tmp/streamjob3628714134396896316.jar

```
13/02/24 20:33:10 INFO util.NativeCodeLoader: Loaded the native-hadoop library
13/02/24 20:33:10 WARN snappy.LoadSnappy: Snappy native library not loaded
13/02/24 20:33:10 INFO mapred.FileInputFormat: Total input paths to process : 1

13/02/24 20:33:10 INFO streaming.StreamJob: getLocalDirs(): [/app/hadoop/tmp/mapred/local]
13/02/24 20:33:10 INFO streaming.StreamJob: Running job: job_201302241759_0005
13/02/24 20:33:10 INFO streaming.StreamJob: To kill this job, run:
13/02/24 20:33:10 INFO streaming.StreamJob: /home/hduser/Downloads/hadoop-1.0.4/libexec/./bin/hadoop j
13/02/24 20:33:10 INFO streaming.StreamJob: Tracking URL: http://localhost:50030/jobdetails.jsp?jobid=j

13/02/24 20:33:11 INFO streaming.StreamJob: map 0% reduce 0%

13/02/24 20:33:23 INFO streaming.StreamJob: map 50% reduce 0%

13/02/24 20:33:26 INFO streaming.StreamJob: map 100% reduce 0%

13/02/24 20:33:35 INFO streaming.StreamJob: map 100% reduce 100%

13/02/24 20:33:42 INFO streaming.StreamJob: Job complete: job_201302241759_0005
13/02/24 20:33:42 INFO streaming.StreamJob: Output: output
```

```
!ssh localhost -l hduser rm -rf /tmp/output
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop dfs -copyToLocal
output /tmp/
```

Ve sonuc altta oldugu gibi

```
!head -10 /tmp/output/part-00000
```

```
AE 12.0
AG 24.0
AN 15.0
AR 10.359999999999999
AT 11.077306733167083
AU 12.789029535864978
BE 11.442748091603054
BG 4.5
BM 8.0
BO 25.0
```

Tabii bu sonuclar bir orneklem uzerinden alindi. Tum veriyi islemek icin

```
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop dfs -copyFromLocal
$HOME/Downloads/apat63_99.txt /user/hduser/patent/apat63_99.txt
```

```
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop dfs -rmr /user/hduser
/output
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop jar /home/hduser/
Downloads/hadoop*/contrib/streaming/hadoop-*streaming*.jar -input patent/apat63_99.
txt -output output -mapper /tmp/mapper.py -reducer /tmp/reducer.py -numReduceTasks 1
```

Deleted hdfs://localhost:54310/user/hduser/output

packageJobJar: [/app/hadoop/tmp/hadoop-unjar938213738183646678/] [] /tmp/streamjob7433279407208888397.jar

```
13/02/24 23:50:12 INFO util.NativeCodeLoader: Loaded the native-hadoop library
13/02/24 23:50:12 WARN snappy.LoadSnappy: Snappy native library not loaded
13/02/24 23:50:12 INFO mapred.FileInputFormat: Total input paths to process : 1
```

```
13/02/24 23:50:12 INFO streaming.StreamJob: getLocalDirs(): [/app/hadoop/tmp/mapred/local]
13/02/24 23:50:12 INFO streaming.StreamJob: Running job: job_201302241759_0006
13/02/24 23:50:12 INFO streaming.StreamJob: To kill this job, run:
13/02/24 23:50:12 INFO streaming.StreamJob: /home/hduser/Downloads/hadoop-1.0.4/libexec/./bin/hadoop j
13/02/24 23:50:12 INFO streaming.StreamJob: Tracking URL: http://localhost:50030/jobdetails.jsp?jobid=j
```

```
13/02/24 23:50:13 INFO streaming.StreamJob: map 0% reduce 0%
```

```
13/02/24 23:50:28 INFO streaming.StreamJob: map 50% reduce 0%
```

```
13/02/24 23:50:40 INFO streaming.StreamJob: map 75% reduce 8%
```

```
13/02/24 23:50:52 INFO streaming.StreamJob: map 100% reduce 8%
```

```
13/02/24 23:50:55 INFO streaming.StreamJob: map 100% reduce 25%
13/02/24 23:51:04 INFO streaming.StreamJob: map 100% reduce 100%
13/02/24 23:51:17 INFO streaming.StreamJob: Job complete: job_201302241759_0006
13/02/24 23:51:17 INFO streaming.StreamJob: Output: output
```

```
!ssh localhost -l hduser rm -rf /tmp/output
!ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop dfs -copyToLocal
output /tmp/
```

```
!head -7 /tmp/output/part-00000
```

```
AD 14.0
AE 15.4
AG 13.25
AI 10.0
AM 18.0
AN 9.625
AR 9.188990825688073
```