

## 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 baglantanidan alinabilir, gerekli dosyalar Dosyalar `cite75_99.txt` ve `apat63_99.txt`. Bu dosyalari acip biz diyelim ki `/data` altina koyduk.

[www.nber.org/patents/](http://www.nber.org/patents/)

Referans verisine bakarsak,

```
! head -10 /data/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 /data/apat63_99.txt
```

```
"PATENT", "GYEAR", "GDATE", "APPYEAR", "COUNTRY", "POSTATE", "ASSIGNEE", "ASSCODE", "CLAIMS"  
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 /data/apat63_99.txt
```

```
! head -1 /data/apat63_99.txt > /data/apat63_99_sampled.txt
```

```
! cat /data/apat63_99.txt | perl -n -e 'print if (rand() < .05)' >> /data/apat63_99
```

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/h

localhost: starting datanode, logging to /home/hduser/Downloads/hadoop-1.0.4/libexe

localhost: starting secondarynamenode, logging to /home/hduser/Downloads/hadoop-1.0

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

localhost: starting tasktracker, logging to /home/hduser/Downloads/hadoop-1.0.4/lib

/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 ... /user/hduser/patent/apat63_99.txt
```

```
-rw-r--r--  1 hduser supergroup ... /user/hduser/patent/apat63_99_sampled.txt
```

```
! ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop \
dfs -copyFromLocal /data/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.

```
#!/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/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/streamjob  
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  
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/lib  
13/02/24 16:30:27 INFO streaming.StreamJob: Tracking URL: http://localhost:50030/jo  
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 -copyToLoc  
! 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 sir-  
alanmamislar. Hatta ustteki sir 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/streamjob  
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  
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/lib  
13/02/24 18:03:14 INFO streaming.StreamJob: Tracking URL: http://localhost:50030/jo  
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 uzer-  
inen ortalama alacak.

```
#!/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/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/streamjob  
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
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/lib
13/02/24 20:33:10 INFO streaming.StreamJob: Tracking URL: http://localhost:50030/jo
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 /data/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/streamjob7
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
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/lib
13/02/24 23:50:12 INFO streaming.StreamJob: Tracking URL: http://localhost:50030/jo
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

```