

## 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 `code/data/code` 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/h
```

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 -copyFromLo
```

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 kendi sine 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/
! ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop jar /home/hdus
```

```
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 `codeIdentityReducer` code  
uzerinden.

```
! ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop dfs -rmr /user/
! ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop jar /home/hdus
```

```
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 -copyToLoc
! 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@hadoop:~/code`'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/
! ssh localhost -l hduser /home/hduser/Downloads/hadoop*/bin/hadoop jar /home/hdus
```

```
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 -copyToLoc
```

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/
```

```
! 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