FBDP第四次实验报告

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实验步骤及截图

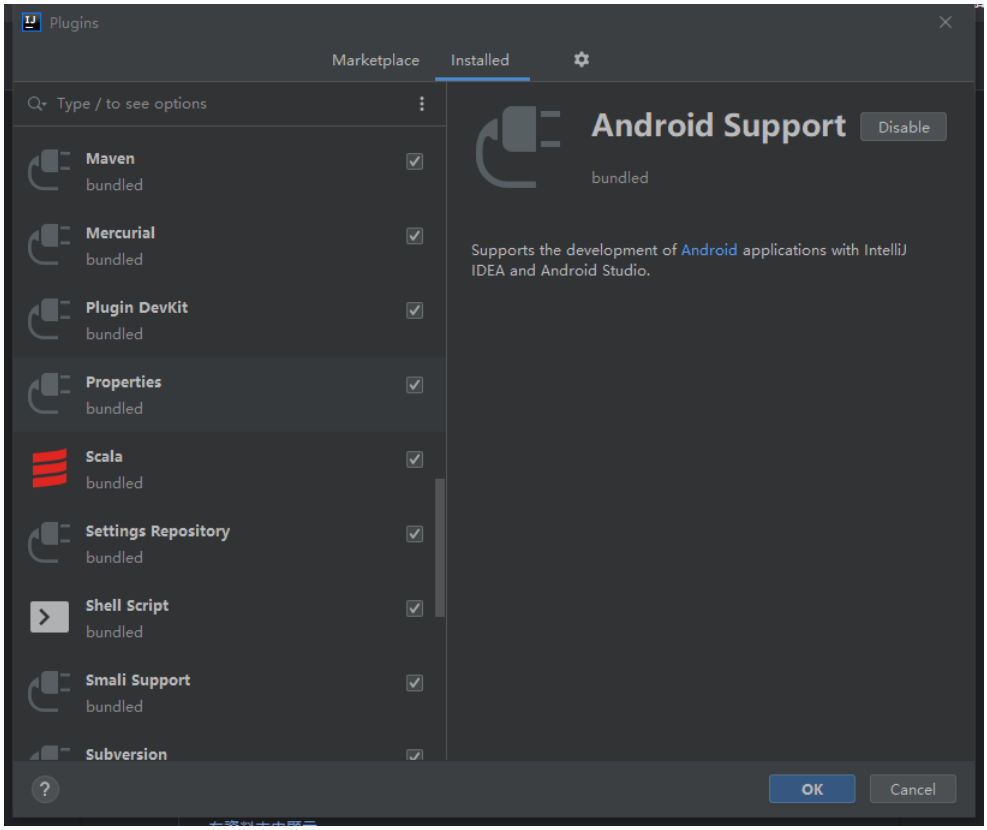
Spark的安装及Intelij IDEA的配置

说明：因为虚拟机性能有所限制，所以直接在本机上配了spark、scala和IntelilJ IDEA

步骤参考：https://blog.csdn.net/xujingpilot/article/details/104322151

Windows下Spark安装成功：

Intelij IDEA中plugins配置完成：



任务一

任务描述：分别编写MapReduce程序和Spark程序统计双十一最热门商品和最受年轻人（age<30）关注的商家（“添加购物车+购买+添加收藏夹”前100名）

MapReduce思路：共一个mapreduce，类似于wordcount的思路，在setup时读取用户信息表，为减少运行时间，只记录年轻人（age_range=1/2/3）的数据，在map阶段记录时间为“1111”，用户操作不为“点击”的user_id和匹配用户为年轻人的merchant_id，将（word,one）传给reduce，再在reduce中排序并保留前100条记录

核心代码：

```
//建立用户信息表
        @Override
        public void setup(Context context) throws
IOException,InterruptedException{
            Configuration conf = context.getConfiguration();
            localFiles  = conf.getStrings("user_info")[0];
            System.out.println(localFiles);
            task=conf.getInt("task_type",1);
            FileSystem fs = FileSystem.get(URI.create(localFiles), conf);
            FSDataInputStream hdfsInStream = fs.open(new Path(localFiles));
            //从hdfs中读取user_info
            InputStreamReader isr = new InputStreamReader(hdfsInStream, "utf-
8");
            String line;
            BufferedReader br = new BufferedReader(isr);
            while ((line = br.readLine()) != null) {
                String[] str=line.split(",");
                String user_id,age_range;
                user_id=str[0];
```

```
                if(str.length==1 || (str.length==2 &&
!line.substring(line.length() - 1).equals(",")))
                    age_range="-1";
                else
                    age_range=str[1];

                // <18岁为1;[18,24]为2;[25,29]为3;[30,34]为4;[35,39]为5;[40,49]为
6;>=50时为7和8;0和NULL表示未知
                // 为了减少运行时间，仅记录年轻人的user_info
                if(age_range.equals("1") || age_range.equals("2") ||
age_range.equals("3"))
                {
                    User u = new User(user_id, age_range);
                    users.add(u);
                }
            }
            System.out.println("Setup Succeed!");
        }

        public void map(Object key, Text value, Context context) throws
IOException, InterruptedException {
            String line = value.toString();
            String[] str=line.split(",");
            String user_id=str[0];
            String item_id=str[1];
            String cat_id=str[2];
            String merchant_id=str[3];
            String brand_id,time_stamp,action_type;
            if(str.length==7){
                brand_id=str[4];
                time_stamp=str[5];
                action_type=str[6];
            }
            else{
                time_stamp=str[4];
                action_type=str[5];
            }
            if(!time_stamp.equals("1111"))
                return;
            switch (task){
                case 1: //双十一最热门商品
                    if(!action_type.equals("0")){
                        id.set(item_id);
                        System.out.println("item id:"+id+" recorded!");
                        context.write(id, one);
                        return;
                    }
                    break;
                case 2: //最受年轻人(age<30)关注的商家
                    if(!action_type.equals("0")){
                        for(User u:users){
                            if(u.user_id.equals(user_id)){
                                id.set(merchant_id);
                                context.write(id, one);
                                return;
                            }
                        }
                    }
```

```
                    break;
            }
        }
    }

    public static class IntSumReducer extends Reducer<Text, IntWritable, Text,
IntWritable> {

        private TreeSet<Item> tree = new TreeSet<Item>();
        private IntWritable result = new IntWritable();

        public void reduce(Text key, Iterable<IntWritable> values, Context
context)
                throws IOException, InterruptedException {
            int sum = 0;
            for (IntWritable val : values) {
                sum += val.get();
            }
            Item item= new Item(key.toString(), (long)sum);
            if (tree.size()<100||tree.last().num<item.num){
                tree.add(item);
            }
            if (tree.size()>100){
                tree.pollLast();
            }
        }

        @Override
        protected void cleanup(Context context) throws IOException,
InterruptedException{
            while(!tree.isEmpty()){
                result.set((int)tree.first().num);
                context.write(new Text(tree.first().id), result);
                tree.pollFirst();
            }
        }
    }
```

MapReduce结果：（左：最热门商品，右：最受年轻人关注商家）

1	191499	2494	1	4044	7278
2	353560	2250	2	3491	3661
3	1059899	1917	3	1102	3588
4	713695	1754	4	3828	3434
5	655904	1674	5	4173	3348
6	67897	1572	6	3734	3303
7	221663	1547	7	2385	3214
8	1039919	1511	8	4976	3064
9	454937	1387	9	798	2997
10	81360	1361	10	422	2893

Spark思路：统计最热门商品时只是简单的map和reduce，统计最受年轻人关注的商家时先利用join函数合并RDD，再进行了mapreduce

核心代码：

```
// 统计最受欢迎商品
var itemCount = textFile2.map(line => (line.split(",", -1)(1),line.split(",",
-1)(5), line.split(",", -1).last)).filter(row => row._2 == "1111").filter(row =>
(row._3 != "0")).map(word => (word._1, 1)).reduceByKey((a, b) => a +
b).sortBy(_._2, false)
itemCount=sc.parallelize(itemCount.take(100))
itemCount.saveAsTextFile("hdfs://localhost:9000/output")
// 统计最受年轻人欢迎商家
val textFile3 = textFile2.map(line => (line.split(",", -1)(0),(line.split(",",
-1)(3),line.split(",", -1)(5), line.split(",", -1).last))).filter(row =>
row._2._2 == "1111").filter(row=>row._2._3!="0")
val textFile4=textFile1.map(line=> (line.split(",",-1)(0), line.split(",", -1)
(1))).filter(row=>row._2=="1"||row._2=="2"||row._2=="3")
// textFile的结构为(user_info,((seller_id,time_stamp,action_type),age_range)
val textFile=textFile3.join(textFile4)
var sellerCount=textFile.map(word => (word._2._1._1, 1)).reduceByKey((a, b) => a
+ b).sortBy(_._2, false)
sellerCount=sc.parallelize(sellerCount.take(100))
```

Spark结果：（左：最热门商品，右：最受年轻人关注商家）

1	(191499,2494)	1	(4044,7278)
2	(353560,2250)	2	(3491,3661)
3	(1059899,1917)	3	(1102,3588)
4	(713695,1754)	4	(3828,3434)
5	(655904,1674)	5	(4173,3348)
6	(67897,1572)	6	(3734,3303)
7	(221663,1547)	7	(2385,3214)
8	(1039919,1511)	8	(4976,3064)
9	(454937,1387)	9	(798,2997)
10	(81360,1361)	10	(422,2893)

任务二

任务描述：编写Spark程序统计双十一购买了商品的男女比例，以及购买了商品的买家年龄段的比例

思路：user_info和user_log两张表Inner Join后用filter("属性"==某值)计数，再计算比例（筛去了gender是2或null，age_range是0或null的用户）

核心代码：

```
// 合并两张表，使数据结构为(user_id,((time_stamp,action_type),(age_range,gender))，此
处采用Inner Join
val textFile3 = textFile2.map(line => (line.split(",", -1)(0),(line.split(",",
-1)(5), line.split(",", -1).last))).filter(row => row._2._1 ==
"1111").filter(row=>row._2._2=="2")
val textFile4=textFile1.map(line=> (line.split(",",-1)(0),(line.split(",",-1)
(1),line.split(",",-1).last)))
val textFile=textFile3.join(textFile4)
```

结果：

```
双十一购买商品的男女比例为:
男: 27.67403%
女: 72.325966%

双十一购买商品的各年龄段比例为:
[0,17]: 0.005504077%
[18,24]: 12.7039175%
[25,29]: 33.407505%
[30,34]: 27.372486%
[35,39]: 13.605263%
[40,49]: 10.577408%
[50,..]: 2.3279185%
```

任务三

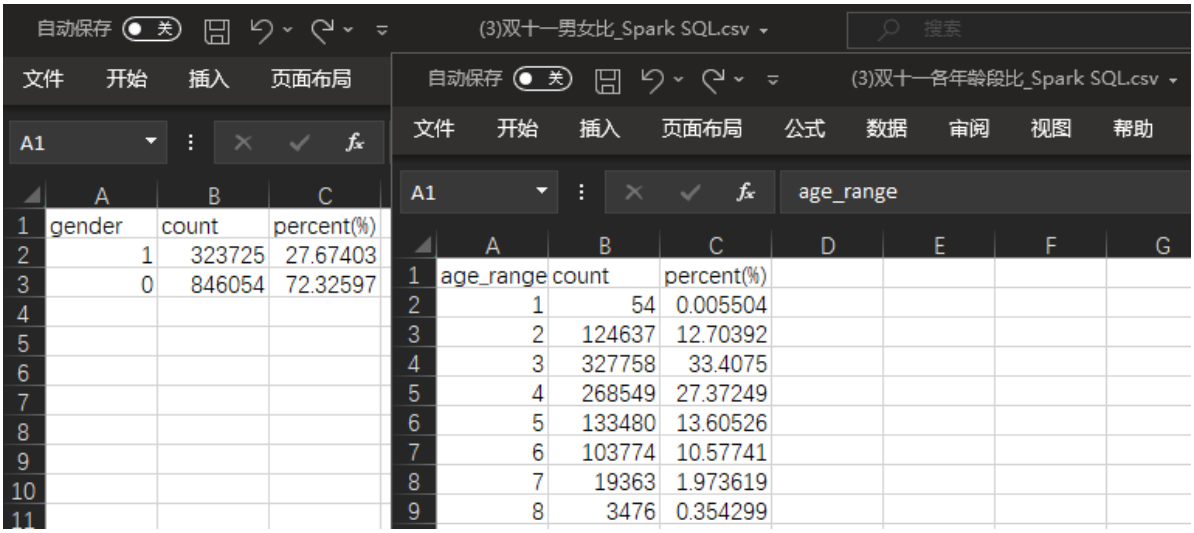
任务描述：基于Hive或Spark SQL查询双十一购买了商品的男女比例，以及购买了商品的买家年龄段的比例

思路：与任务二不同的是，使用了groupBY语句使得代码更加精简了

核心代码：

```
// 筛选时间戳和action_type
val logDF2=spark.sql("SELECT a.user_id,a.action_type FROM user_log a WHERE
a.action_type=2 AND a.time_stamp=1111")
logDF2.createTempView("filtered_log")
// 合并info和log两张表，此处采用Inner Join
val sqlDF=spark.sql("SELECT a.*,b.age_range,b.gender FROM filtered_log a JOIN
user_info b ON a.user_id = b.user_id")
sqlDF.createTempView("FinalTable")
// 计算性别、年龄比例
var Count_gender = sqlDF.groupBy($"gender").count()
Count_gender=Count_gender.filter($"gender"===1 || $"gender"===0)
Count_gender=Count_gender.withColumn("percent(%)",$"count".divide(sum($"count").
over()).multiply(100))
var Count_age_range = sqlDF.groupBy($"age_range").count()
Count_age_range=Count_age_range.filter($"age_range">0 && $"age_range"<9)
Count_age_range=Count_age_range.withColumn("percent(%)",$"count".divide(sum($"co
unt").over()).multiply(100))
Count_age_range=Count_age_range.sort($"age_range")
```

结果：



(3)双十一男女比_Spark SQL.csv

	A	B	C
1	gender	count	percent(%)
2	1	323725	27.67403
3	0	846054	72.32597

(3)双十一各年龄段比_Spark SQL.csv

	A	B	C	D	E	F	G
1	age_range	count	percent(%)				
2	1	54	0.005504				
3	2	124637	12.70392				
4	3	327758	33.4075				
5	4	268549	27.37249				
6	5	133480	13.60526				
7	6	103774	10.57741				
8	7	19363	1.973619				
9	8	3476	0.354299				

任务四

任务描述：预测给定的商家中，哪些新消费者在未来会成为忠实客户，即需要预测这些新消费者在6个月内再次购买的概率。基于Spark MLlib编写程序预测回头客，评估实验结果的准确率。

思路：

- 新增特征：
  - 用户×商家：
    - user_view_seller_count：该用户对该商家有过几次action
    - view_count/addcart_count/ buy_count/ star_count：该用户对该商家各种action_type的计数
    - buy_ratio：购买次数/action次数
    - buy_ratio2：购买次数/加购物车+购买+收藏次数
    - time_var：该用户在该商家购买时间戳方差
    - item_viewed_count/cat_viewed_count/brand_viewed_count：该用户在该商家浏览过的商品/商品类别/品牌种类
  - 商家：
    - seller_viewed_count：该商家总共被action过几次
    - female_count/male_count：该商家的女/男性买家人数
    - female_ratio/male_ratio：该商家的女/男性买家人数比例
- 特征工程：下采样，随机取训练集中label=0的十五分之一的数据+训练集中label=1的全部数据，使两种标签数目相近
- 模型训练：采用XGBoostClassifier进行模型训练，并调参

代码（太长了略）

结果：天池score：0.6011080

遇到的问题及解决方案

问题一

问题描述&解决方案：xgboost4j对windows系统十分不友好，需要另外下载对应版本的xgboost4j.dll，再复制到xgboost4j的jar包里去；然而现成的xgboost4j.dll只有scala为2.11版本的，我之前配置的scala是2.12版本的，和2.11有冲突，scala版本之间的冲突又会导致更多的问题（包括一直报XGBoostModel trainning failed的错），所以为了解决版本不一致的问题，又把spark从头装了一遍，将原先的3.0.1版本换成了2.4.7版本，对应2.11.12版本的scala。

吐槽：虽然scala语言比较简洁，但是各种各样的版本问题实在是非常浪费时间，比如说这个问题浪费了我整整一天，python相对来说语句没那么简洁，但不会出现版本或者配置问题。

```
C:\Users\Alienware>spark-shell
Using Spark's default log4j profile: org/apache/spark/log4j-defaults.properties
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use setLogLevel(newLevel).
20/12/30 05:40:48 WARN Utils: Service 'SparkUI' could not bind on port 4040. Attempting port 4041.
Spark context Web UI available at http://windows10.microdone.cn:4041
Spark context available as 'sc' (master = local[*], app id = local-1609278048598).
Spark session available as 'spark'.
Welcome to
      ____              __
     / __/__  ___ _____/ /__
    _\ \/ _ \/ _ `/ __/  '_/
   /___/ .__/\_,_/_/ /_/\_\   version 2.4.7
      /_/

Using Scala version 2.11.12 (Java HotSpot(TM) 64-Bit Server VM, Java 1.8.0_152)
Type in expressions to have them evaluated.
Type :help for more information.

scala>
```

问题二

问题：

```
20/12/21 23:27:09 WARN namenode.FSEditLog: No class configured for D, dfs.namenode.edits.journal-plugin.D is empty
20/12/21 23:27:09 ERROR namenode.NameNode: Failed to start namenode.
java.lang.IllegalArgumentException: No class configured for D
        at org.apache.hadoop.hdfs.server.namenode.FSEditLog.getJournalClass(FSEditLog.java:1615)
        at org.apache.hadoop.hdfs.server.namenode.FSEditLog.createJournal(FSEditLog.java:1629)
        at org.apache.hadoop.hdfs.server.namenode.FSEditLog.initJournals(FSEditLog.java:282)
        at org.apache.hadoop.hdfs.server.namenode.FSEditLog.initJournalsForWrite(FSEditLog.java:247)
        at org.apache.hadoop.hdfs.server.namenode.NameNode.format(NameNode.java:985)
        at org.apache.hadoop.hdfs.server.namenode.NameNode.createNameNode(NameNode.java:1429)
        at org.apache.hadoop.hdfs.server.namenode.NameNode.main(NameNode.java:1554)
20/12/21 23:27:09 INFO util.ExitUtil: Exiting with status 1
20/12/21 23:27:09 INFO namenode.NameNode: SHUTDOWN_MSG:
/************************************************************
```

解决方案：在hadoop配置文件中D:/some_path前面加上/，变为/D:/some_path

core-site.xml - 记事本

```
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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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limitations under the License. See accompanying LICENSE file.
-->

<!-- Put site-specific property overrides in this file. -->

<configuration>
    <property>
        <name>hadoop.tmp.dir</name>
        <value>/D:/hadoop/hadoop-2.7.1/data/tmp</value>
        <description>Abase for other temporary directories.</description>
    </property>
    <property>
        <name>fs.defaultFS</name>
        <value>hdfs://localhost:9000</value>
    </property>
</configuration>
```

hdfs-site.xml - 记事本

```
-->

<!-- Put site-specific property overrides in this file. -->

<configuration>
 <property>
      <name>dfs.replication</name>
      <value>1</value>
  </property>
  <property>
      <name>dfs.namenode.name.dir</name>
      <value>/D:/hadoop/hadoop-2.7.1/data/namenode</value>
  </property>
  <property>
      <name>dfs.datanode.data.dir</name>
      <value>/D:/hadoop/hadoop-2.7.1/data/datanode</value>
  </property>
  <property>
      <name>dfs.http.address</name>
      <value>127.0.0.1:50070</value>
  </property>
  <property>
      <name>dfs.permissions.enabled</name>
      <value>false</value>
  </property>
</configuration>
```

问题三

问题：权限不够

```
Diagnostics: Exception from container-launch.
Container id: container_1608564909588_0001_02_000001
Exit code: 1
Exception message: CreateSymbolicLink error (1314): ??????????



Stack trace: ExitCodeException exitCode=1: CreateSymbolicLink error (1314): ??????????
```

解决方案：

1. win+R gpedit.msc
2. 计算机配置->windows设置->安全设置->本地策略->用户权限分配->创建符号链接。
3. 把用户添加进去，重启或者注销

思考

改进方向

数据其实还可以挖出来很多，也可以再增加只与用户有关的数据，比如说某用户买得最多的商品/店铺/品牌/类别；成绩较好的选手的经验贴上有写道似乎用上处理过（类似于转成稀疏向量）的user_id和seller_id效果会很好，所以尝试着编了一下独热，但最后因为XGBoost对features格式的限制没有用上，也考虑再换个模型试试。特征工程部分目前的采样方法比较简单，后期可以尝试一下别的采样方法，然后因为数据的维度也比较多，也考虑进行降维/特征提取。

心得体会

从一堆看起来不是都能用的数据里，提取有效信息并且得出结果，是一件很有成就感的事情，虽然score没有特别好，不过也大概能说明并不是在做无用功。并且因为并行处理，速度快了很多。不过调参真的不太有意思，以后可能还是倾向于用pyspark接口写代码，用GridSearchCV自动调参比较省心。