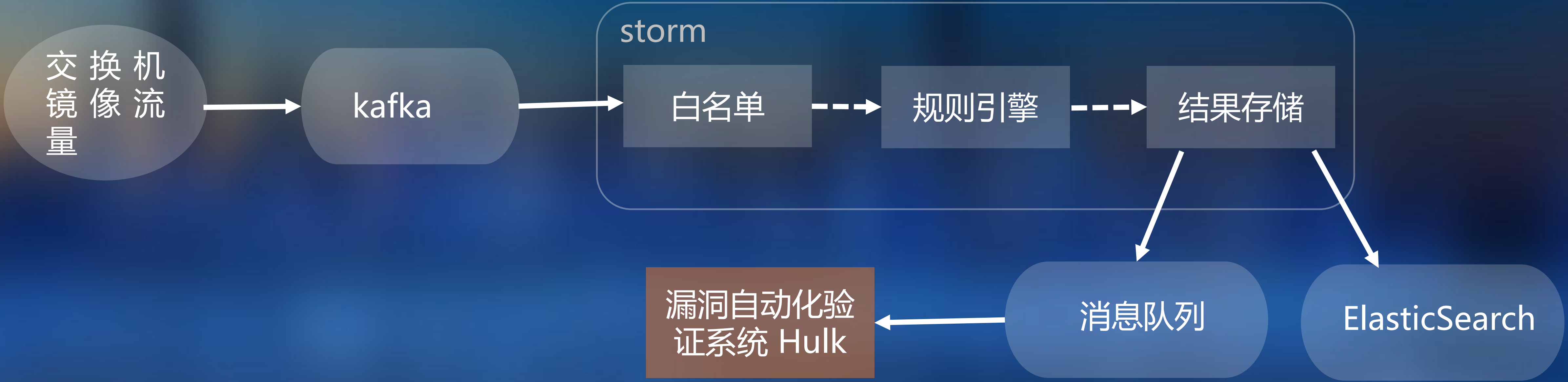
# 实时攻击检测智能化之路

携程信息安全部 – 陈莹

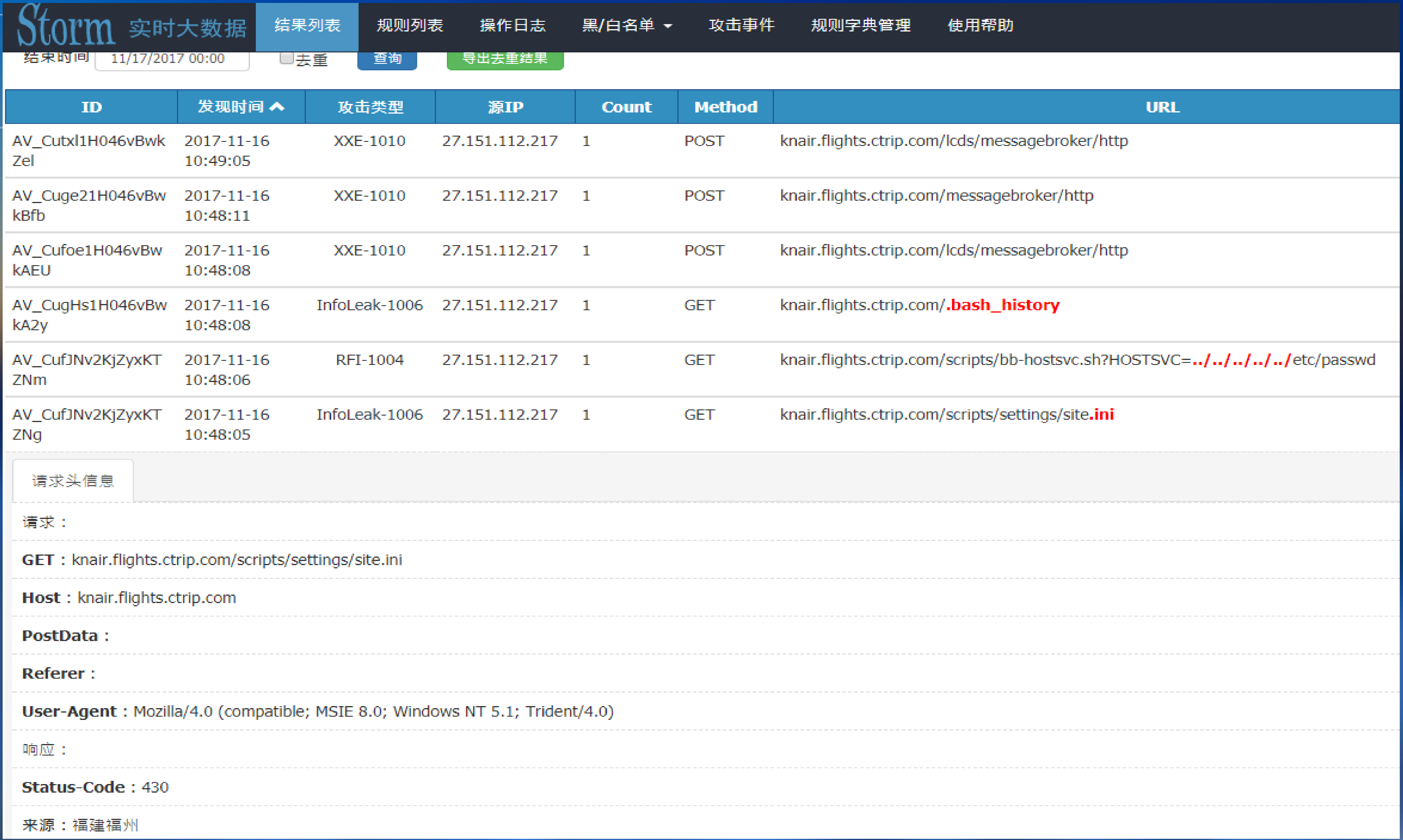
# CONTENTS

- 系统介绍
- 智能进化
- 未来

# 系统介绍 - Nile



交换机镜像流量
kafka
storm
白名单
规则引擎
结果存储
消息队列
ElasticSearch
漏洞自动化验证系统 Hulk



| ID | 发现时间 | 攻击类型 | 源IP | Count | Method | URL |
|---|---|---|---|---|---|---|
| AV_Cutxl1H046vBwkZel | 2017-11-16 10:49:05 | XXE-1010 | 27.151.112.217 | 1 | POST | knair.flights.ctrip.com/lcds/messagebroker/http |
| AV_Cuge21H046vBwkBfb | 2017-11-16 10:48:11 | XXE-1010 | 27.151.112.217 | 1 | POST | knair.flights.ctrip.com/messagebroker/http |
| AV_Cufoe1H046vBwkAEU | 2017-11-16 10:48:08 | XXE-1010 | 27.151.112.217 | 1 | POST | knair.flights.ctrip.com/lcds/messagebroker/http |
| AV_CugHs1H046vBwkA2y | 2017-11-16 10:48:08 | InfoLeak-1006 | 27.151.112.217 | 1 | GET | knair.flights.ctrip.com/**.bash_history** |
| AV_CufJNv2KjZyxKTZNm | 2017-11-16 10:48:06 | RFI-1004 | 27.151.112.217 | 1 | GET | knair.flights.ctrip.com/scripts/bb-hostsvc.sh?HOSTSVC=**../../../../../**etc/passwd |
| AV_CufJNv2KjZyxKTZNg | 2017-11-16 10:48:05 | InfoLeak-1006 | 27.151.112.217 | 1 | GET | knair.flights.ctrip.com/scripts/settings/site**.ini** |

请求：

**GET**：knair.flights.ctrip.com/scripts/settings/site.ini

**Host**：knair.flights.ctrip.com

**PostData**：

**Referer**：

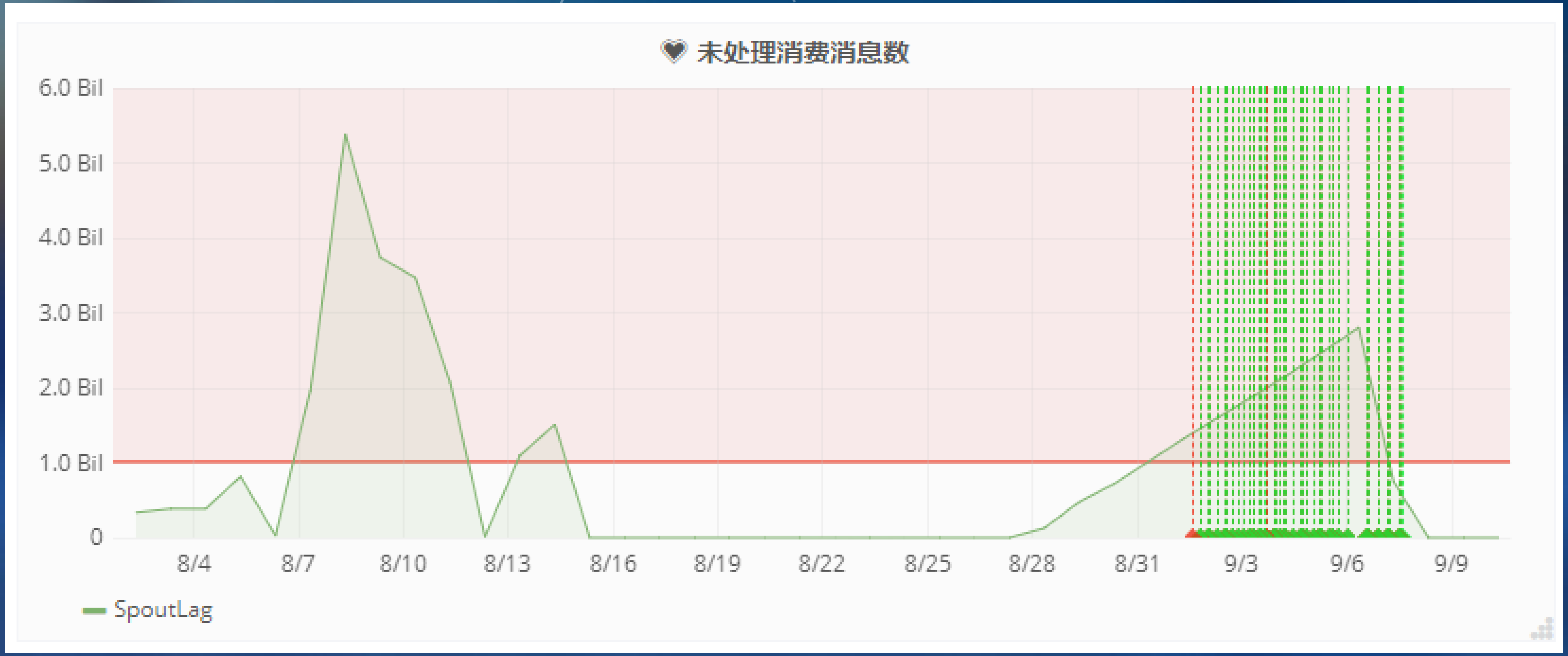
**User-Agent**：Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 5.1; Trident/4.0)

响应：

**Status-Code**：430

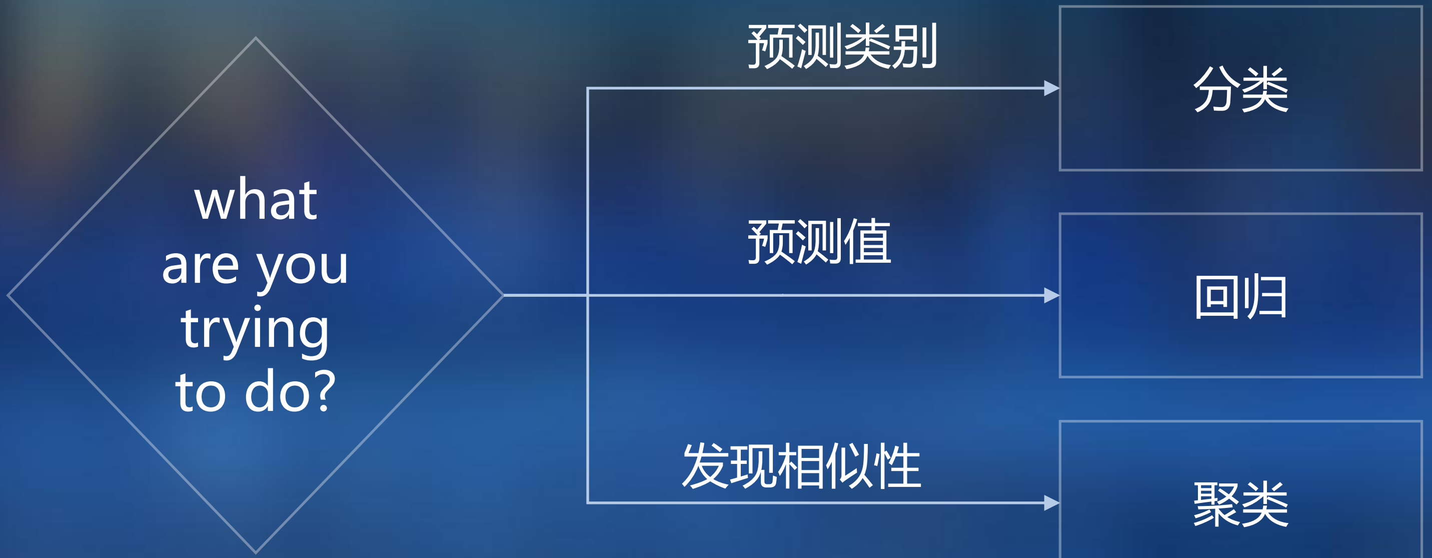
来源：福建福州

# 存在的问题



未处理消费消息数
6.0 Bil
5.0 Bil
4.0 Bil
3.0 Bil
2.0 Bil
1.0 Bil
0
8/4
8/7
8/10
8/13
8/16
8/19
8/22
8/25
8/28
8/31
9/3
9/6
9/9
SpoutLag

# 机器学习可以解决的问题



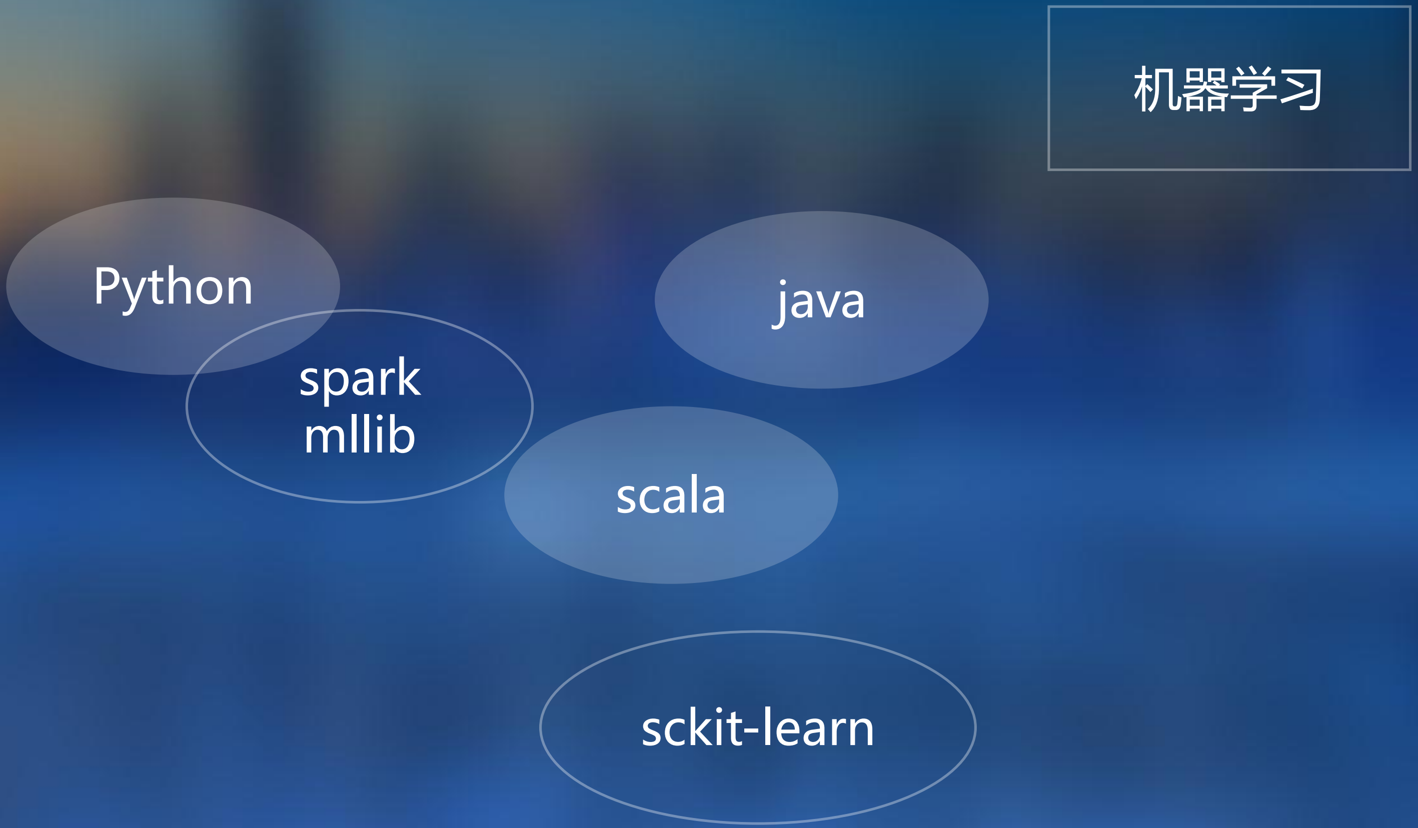
what are you trying to do?

预测类别 → 分类

预测值 → 回归

发现相似性 → 聚类

# 方案选择



机器学习

Python

spark mllib

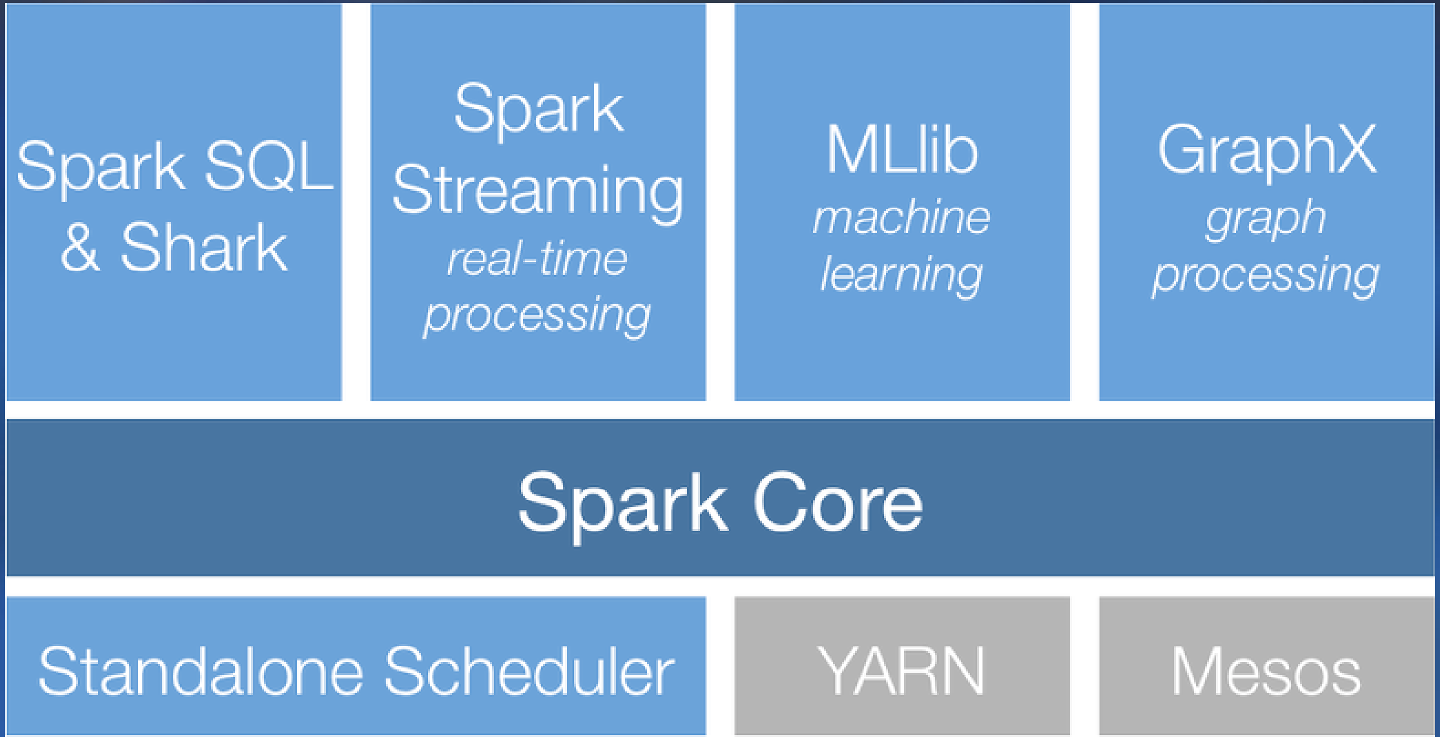
java

scala

sckit-learn

# Spark 介绍

Apache Spark™ is a fast and general engine for large-scale data processing.



Spark SQL & Shark

Spark Streaming *real-time processing*

MLlib *machine learning*

GraphX *graph processing*

Spark Core

Standalone Scheduler

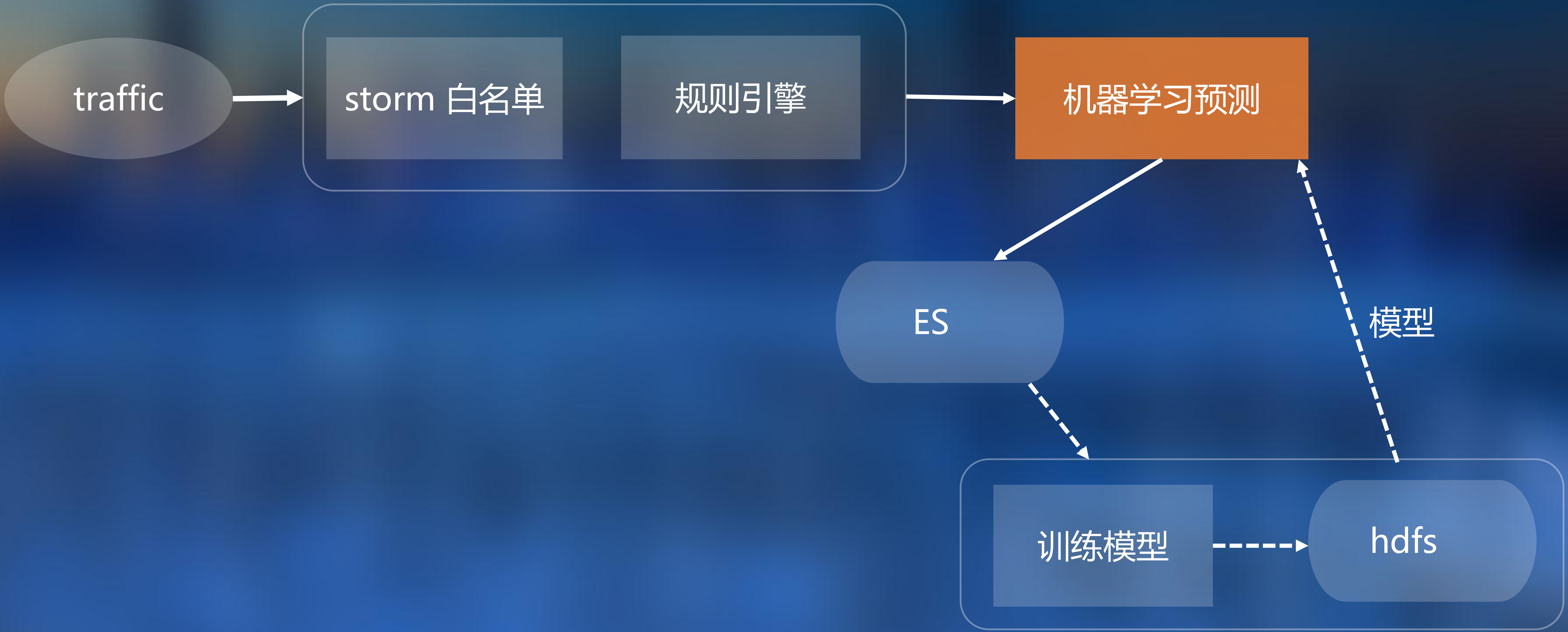
YARN

Mesos

# 机器学习流程

1. 收集样本
2. 数据清洗，打标签
3. 特征提取
4. 模型训练
5. 验证模型，调优
6. 预测分类

# 1.0 之架构



# 1.0

- 数据：url和postdata
- 特征选择：url decode+正则
- 算法：svm
- 算法库： spark mllib

# 1.0 之样本

## 样本收集

恶意样本

- nile 命中规则的结果
- waf 日志
- 网上收集poc

非恶意样本

- 交换机镜像的流量

## 样本清洗

脚本关键字+ 人眼观察

# 1.0 之特征

统计每个request中如下敏感符号,关键字的个数
, . ! * \ / ( & < > 等等
eval ongl script select等等
然后转换成一个1*n的矩阵，所有的训练样本就是m*n的输入

and 1=(select count(*) from master.dbo.sysobjects where xtype = 'x' and name = 'xp_cmdshell')

[2,1,3,...........1,2,0] ，代表2个( ,2个),3个'等
存在的问题：
总有遗漏的关键词

# 1.0 之算法

| 测试算法 | 误报率 | 漏报率 |
|---|---|---|
| 决策树 | 9.9% | 8.4% |
| svm | 8.8% | 8.9% |
| 朴素贝叶斯 | 11% | 9.6% |

# 1.0

## 进步

从无到有，流程跑通

## 不足

特征太依赖于正则了，
不够智能

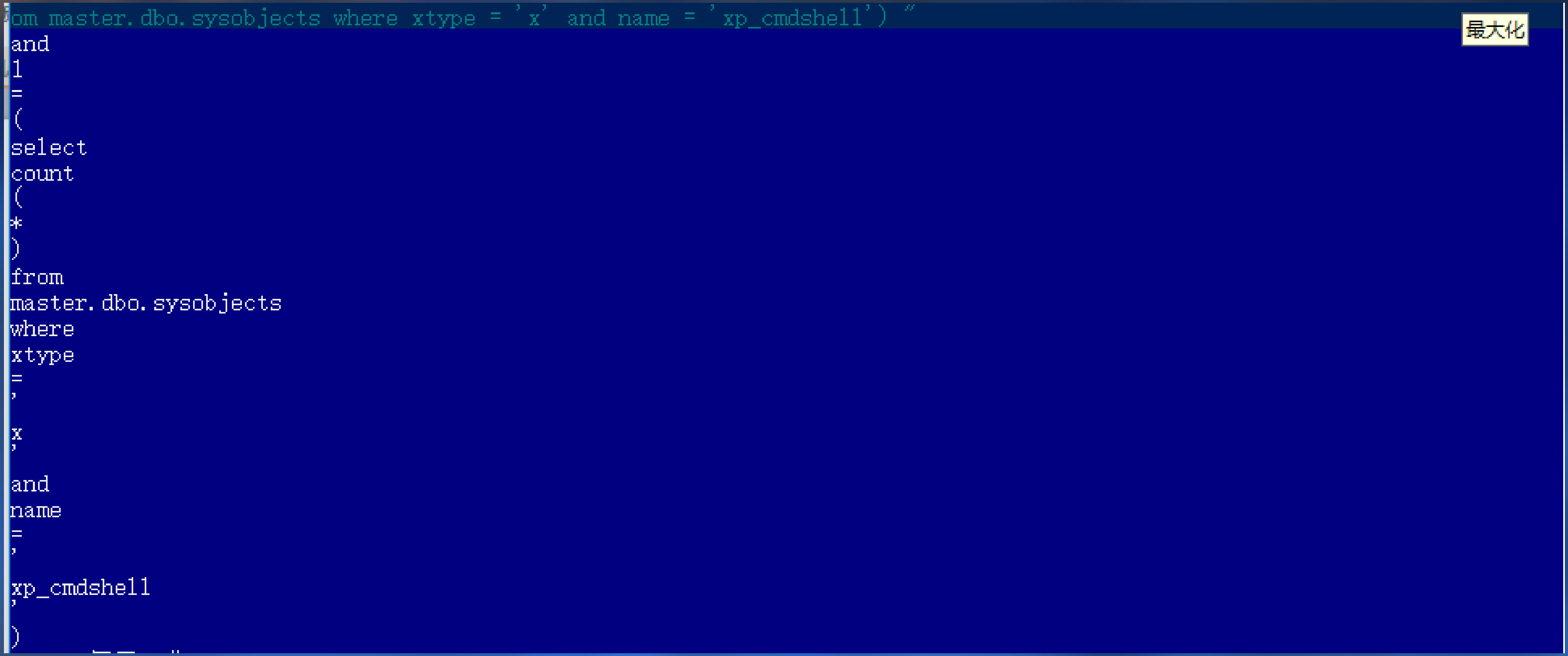
# 2.0

- 分词：WordParser
- 特征提取：TF-IDF（Hashing TF and IDF）

# 特征之WordParser

将每一个标点和控制符都“转换”为词，例如

and 1=(select count(*) from master.dbo.sysobjects where xtype = ‘x’ and name = ‘xp_cmdshell’ )



```
om master.dbo.sysobjects where xtype = 'x' and name = 'xp_cmdshell') "
and
1
=
(
select
count
(
*
)
from
master.dbo.sysobjects
where
xtype
=
'

x
'

and
name
=
'

xp_cmdshell
'

)
```

# 特征提取之TF-IDF

$$\text{词频(TF)} = \frac{\text{某个词在文章中的出现次数}}{\text{文章的总词数}}$$

$$\text{逆文档频率(IDF)} = \log(\frac{\text{语料库的文档总数}}{\text{包含该词的文档数} + 1})$$

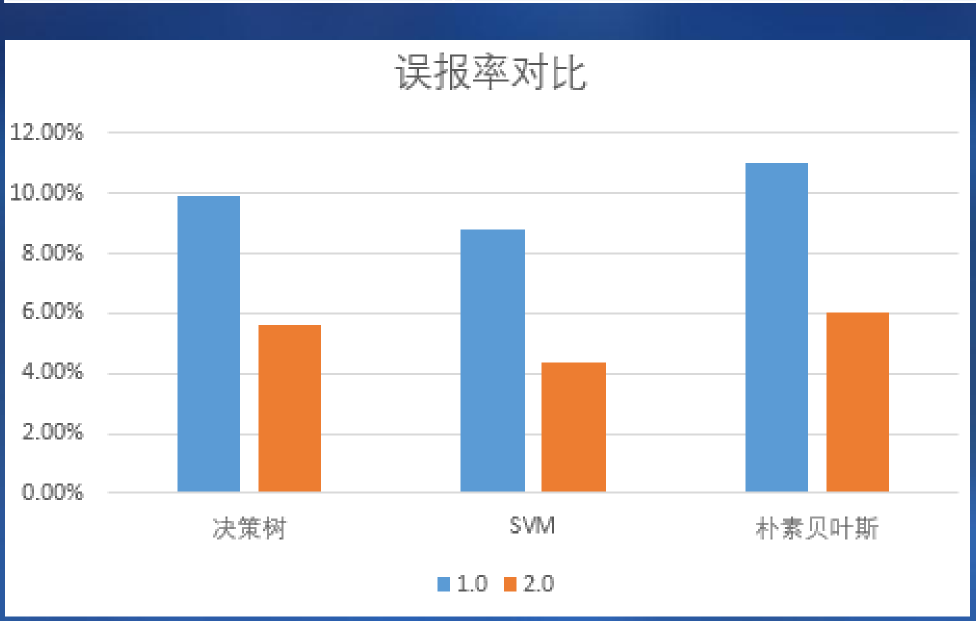
$$\text{TF} - \text{IDF} = \text{词频(TF)} \times \text{逆文档频率 ( IDF )}$$

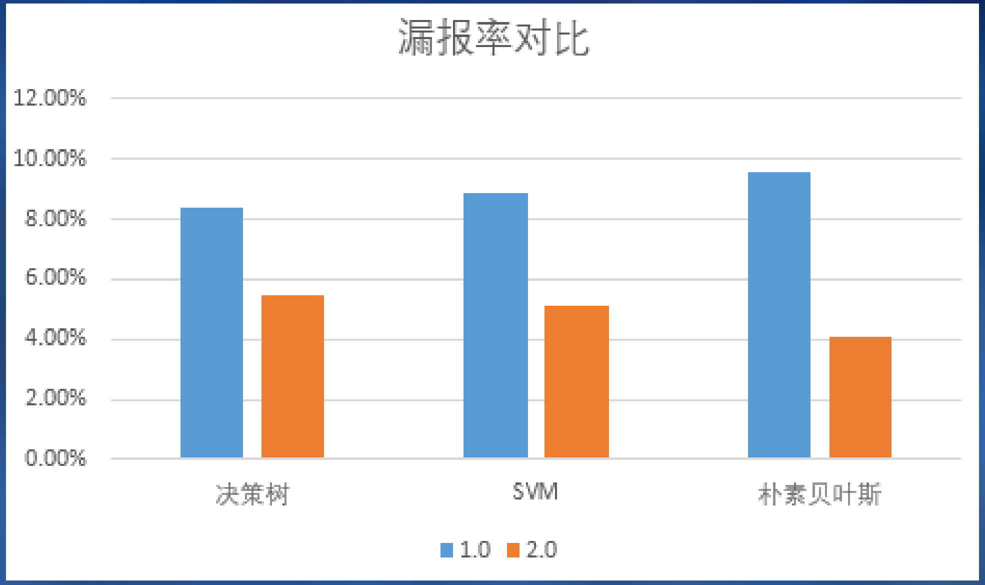
例如我们有很多条get请求语句，第一条语句共计10个单词，其中单引号有3个，1000条语句中有10条语句包含单引号

| | 包含该词的语句个数 | TF | IDF | TF-IDF |
|---|---|---|---|---|
| 单引号 | 10 | 0.3 | 1.958 | 0.5874 |
| from | 100 | 0.3 | 0.995 | 0.3318 |

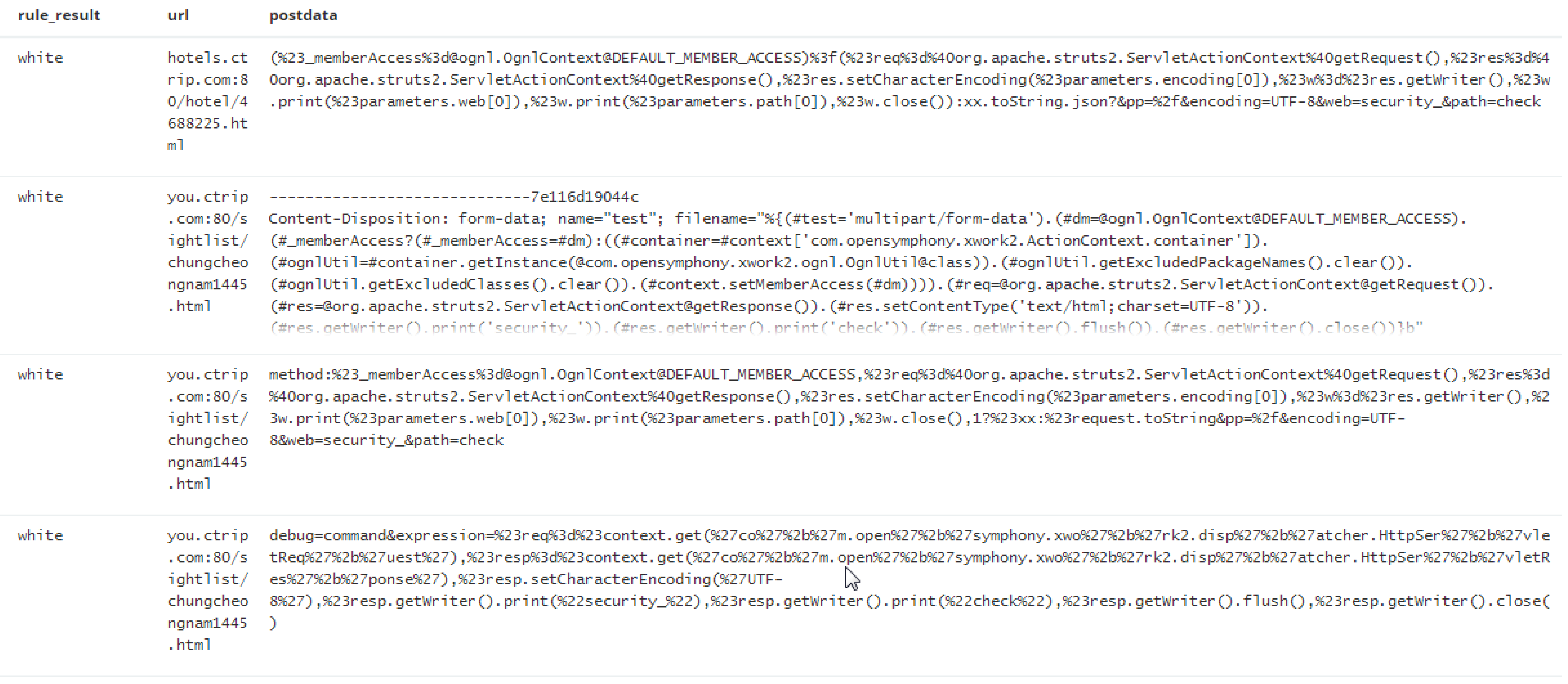
# 2.0 之 算法

| 测试算法 | 误报率 | 漏报率 |
|---|---|---|
| 决策树 | 5.6% | 5.5% |
| svm | 4.4% | 5.1% |
| 朴素贝叶斯 | 6.0% | 4.1% |


误报率对比

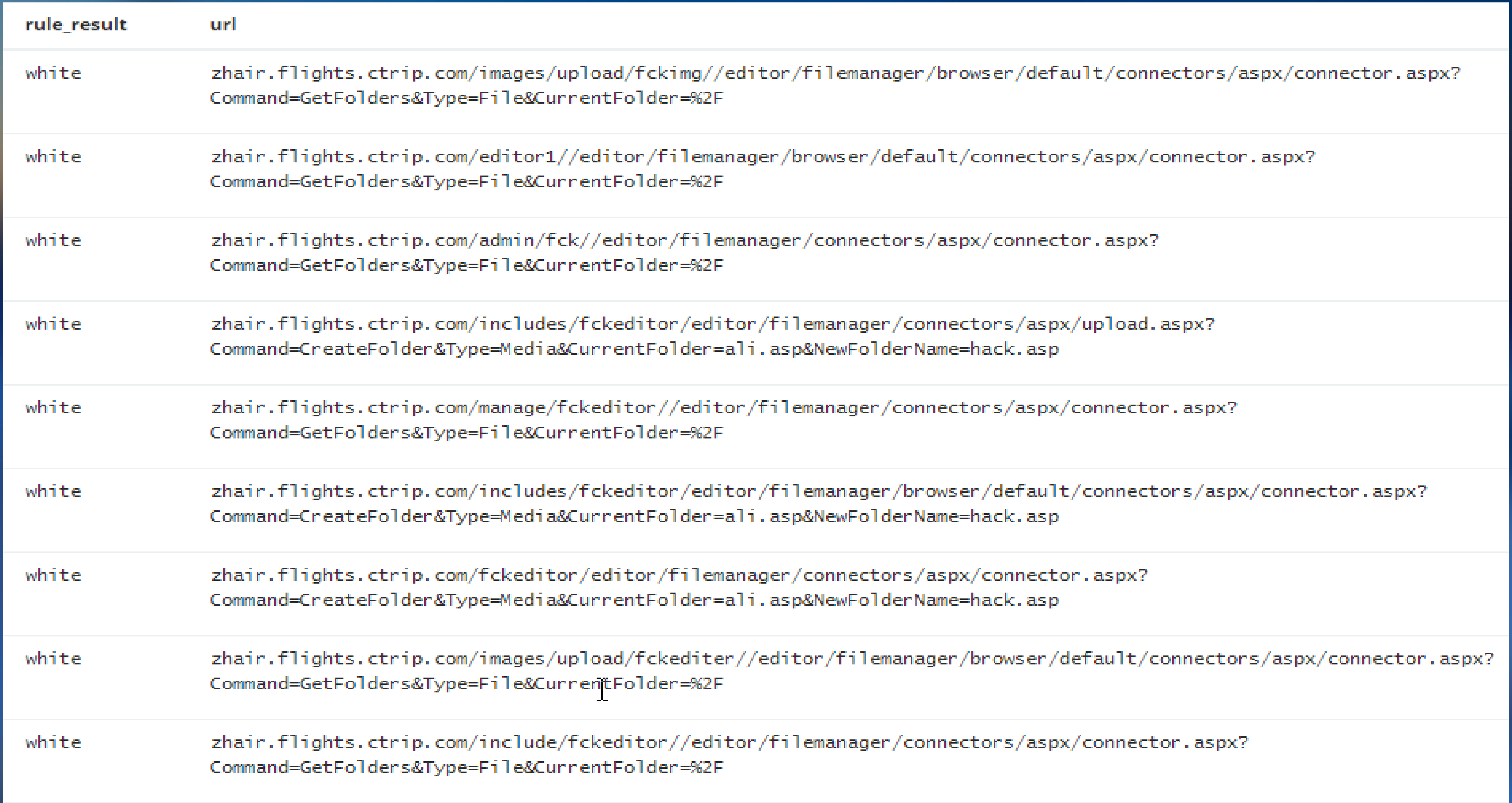

漏报率对比

# 效果



| rule_result | url | postdata |
|---|---|---|
| white | hotels.ctrip.com:80/hotel/4688225.html | (%23_memberAccess%3d@ognl.OgnlContext@DEFAULT_MEMBER_ACCESS)%3f(%23req%3d%40org.apache.struts2.ServletActionContext%40getRequest(),%23res%3d%40org.apache.struts2.ServletActionContext%40getResponse(),%23res.setCharacterEncoding(%23parameters.encoding[0]),%23w%3d%23res.getWriter(),%23w.print(%23parameters.web[0]),%23w.print(%23parameters.path[0]),%23w.close()):xx.toString.json?&pp=%2f&encoding=UTF-8&web=security_&path=check |
| white | you.ctrip.com:80/sightlist/chungcheongnam1445.html | -----------------------------7e116d19044c<br>Content-Disposition: form-data; name="test"; filename="%{(#test='multipart/form-data').(#dm=@ognl.OgnlContext@DEFAULT_MEMBER_ACCESS).(#_memberAccess?(#_memberAccess=#dm):((#container=#context['com.opensymphony.xwork2.ActionContext.container']).(#ognlUtil=#container.getInstance(@com.opensymphony.xwork2.ognl.OgnlUtil@class)).(#ognlUtil.getExcludedPackageNames().clear()).(#ognlUtil.getExcludedClasses().clear()).(#context.setMemberAccess(#dm)))).(#req=@org.apache.struts2.ServletActionContext@getRequest()).(#res=@org.apache.struts2.ServletActionContext@getResponse()).(#res.setContentType('text/html;charset=UTF-8')).(#res.getWriter().print('security_')).(#res.getWriter().print('check')).(#res.getWriter().flush()).(#res.getWriter().close())}b" |
| white | you.ctrip.com:80/sightlist/chungcheongnam1445.html | method:%23_memberAccess%3d@ognl.OgnlContext@DEFAULT_MEMBER_ACCESS,%23req%3d%40org.apache.struts2.ServletActionContext%40getRequest(),%23res%3d%40org.apache.struts2.ServletActionContext%40getResponse(),%23res.setCharacterEncoding(%23parameters.encoding[0]),%23w%3d%23res.getWriter(),%23w.print(%23parameters.web[0]),%23w.print(%23parameters.path[0]),%23w.close(),1?%23xx:%23request.toString&pp=%2f&encoding=UTF-8&web=security_&path=check |
| white | you.ctrip.com:80/sightlist/chungcheongnam1445.html | debug=command&expression=%23req%3d%23context.get(%27co%27%2b%27m.open%27%2b%27symphony.xwo%27%2b%27rk2.disp%27%2b%27atcher.HttpSer%27%2b%27vletReq%27%2b%27uest%27),%23resp%3d%23context.get(%27co%27%2b%27m.open%27%2b%27symphony.xwo%27%2b%27rk2.disp%27%2b%27atcher.HttpSer%27%2b%27vletRes%27%2b%27ponse%27),%23resp.setCharacterEncoding(%27UTF-8%27),%23resp.getWriter().print(%22security_%22),%23resp.getWriter().print(%22check%22),%23resp.getWriter().flush(),%23resp.getWriter().close() |

# 效果



| rule_result | url |
|---|---|
| white | zhair.flights.ctrip.com/images/upload/fckimg//editor/filemanager/browser/default/connectors/aspx/connector.aspx?Command=GetFolders&Type=File&CurrentFolder=%2F |
| white | zhair.flights.ctrip.com/editor1//editor/filemanager/browser/default/connectors/aspx/connector.aspx?Command=GetFolders&Type=File&CurrentFolder=%2F |
| white | zhair.flights.ctrip.com/admin/fck//editor/filemanager/connectors/aspx/connector.aspx?Command=GetFolders&Type=File&CurrentFolder=%2F |
| white | zhair.flights.ctrip.com/includes/fckeditor/editor/filemanager/connectors/aspx/upload.aspx?Command=CreateFolder&Type=Media&CurrentFolder=ali.asp&NewFolderName=hack.asp |
| white | zhair.flights.ctrip.com/manage/fckeditor//editor/filemanager/connectors/aspx/connector.aspx?Command=GetFolders&Type=File&CurrentFolder=%2F |
| white | zhair.flights.ctrip.com/includes/fckeditor/editor/filemanager/browser/default/connectors/aspx/connector.aspx?Command=CreateFolder&Type=Media&CurrentFolder=ali.asp&NewFolderName=hack.asp |
| white | zhair.flights.ctrip.com/fckeditor/editor/filemanager/connectors/aspx/connector.aspx?Command=CreateFolder&Type=Media&CurrentFolder=ali.asp&NewFolderName=hack.asp |
| white | zhair.flights.ctrip.com/images/upload/fckediter//editor/filemanager/browser/default/connectors/aspx/connector.aspx?Command=GetFolders&Type=File&CurrentFolder=%2F |
| white | zhair.flights.ctrip.com/include/fckeditor//editor/filemanager/connectors/aspx/connector.aspx?Command=GetFolders&Type=File&CurrentFolder=%2F |

# 2.0

**进步**

可以靠数据变得更强
真正开始智能化

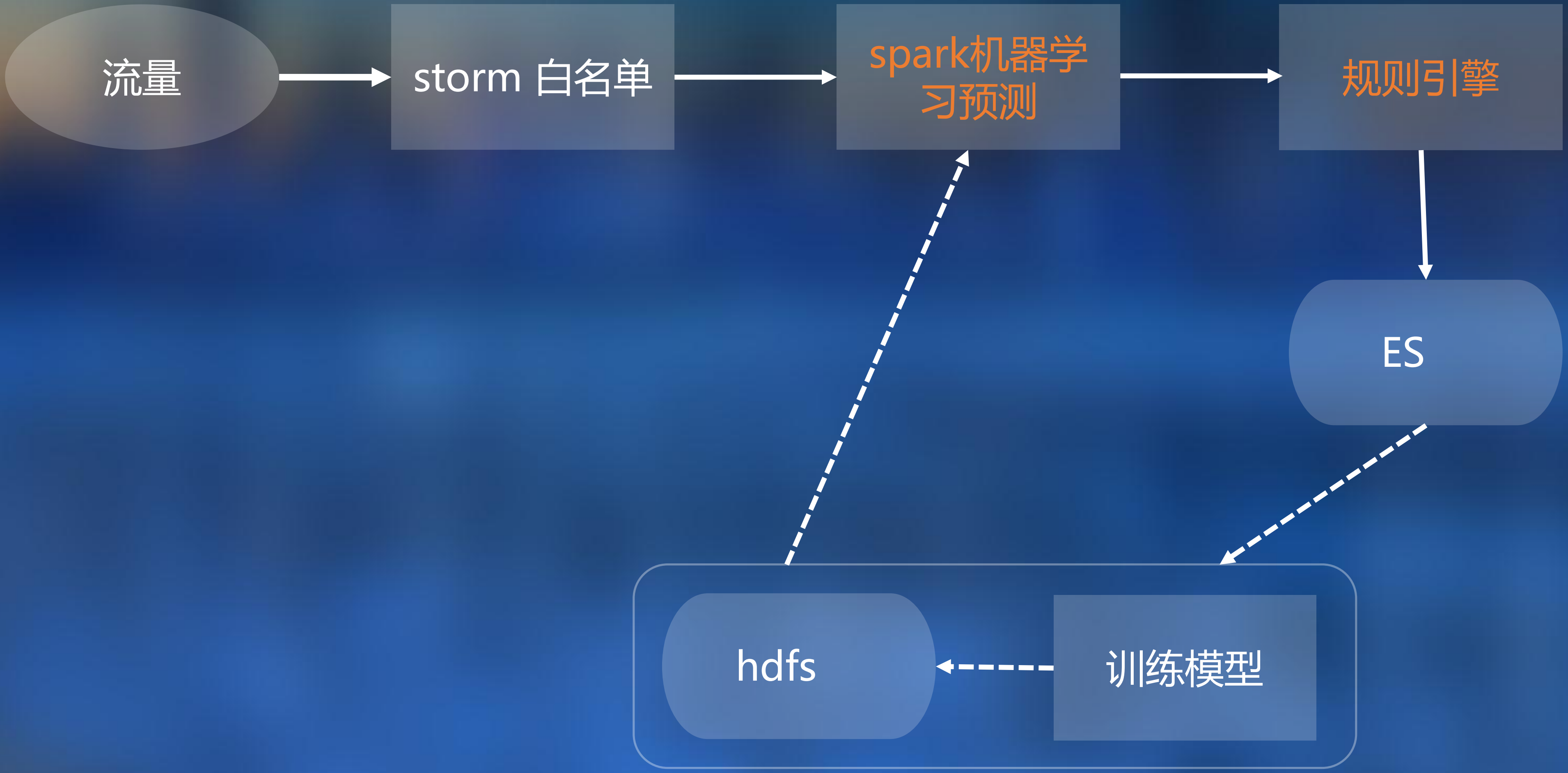
**不足**

未解决性能问题

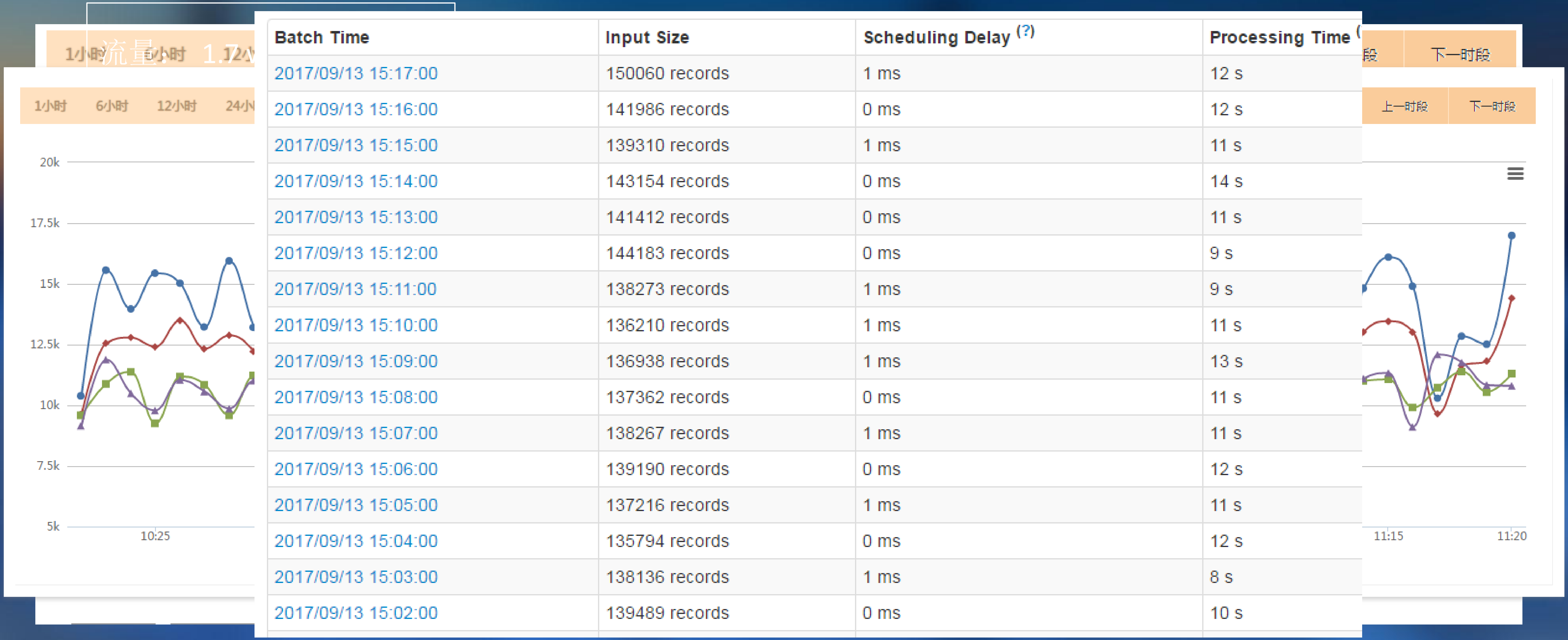
# 3.0

- 架构调整

# 3.0 -- 架构



# 性能效果



| Batch Time | Input Size | Scheduling Delay (?) | Processing Time ( |
|---|---|---|---|
| 2017/09/13 15:17:00 | 150060 records | 1 ms | 12 s |
| 2017/09/13 15:16:00 | 141986 records | 0 ms | 12 s |
| 2017/09/13 15:15:00 | 139310 records | 1 ms | 11 s |
| 2017/09/13 15:14:00 | 143154 records | 0 ms | 14 s |
| 2017/09/13 15:13:00 | 141412 records | 0 ms | 11 s |
| 2017/09/13 15:12:00 | 144183 records | 0 ms | 9 s |
| 2017/09/13 15:11:00 | 138273 records | 1 ms | 9 s |
| 2017/09/13 15:10:00 | 136210 records | 1 ms | 11 s |
| 2017/09/13 15:09:00 | 136938 records | 1 ms | 13 s |
| 2017/09/13 15:08:00 | 137362 records | 0 ms | 11 s |
| 2017/09/13 15:07:00 | 138267 records | 1 ms | 11 s |
| 2017/09/13 15:06:00 | 139190 records | 0 ms | 12 s |
| 2017/09/13 15:05:00 | 137216 records | 1 ms | 11 s |
| 2017/09/13 15:04:00 | 135794 records | 0 ms | 12 s |
| 2017/09/13 15:03:00 | 138136 records | 1 ms | 8 s |
| 2017/09/13 15:02:00 | 139489 records | 0 ms | 10 s |

# 3.0

**进步**

性能大幅提高

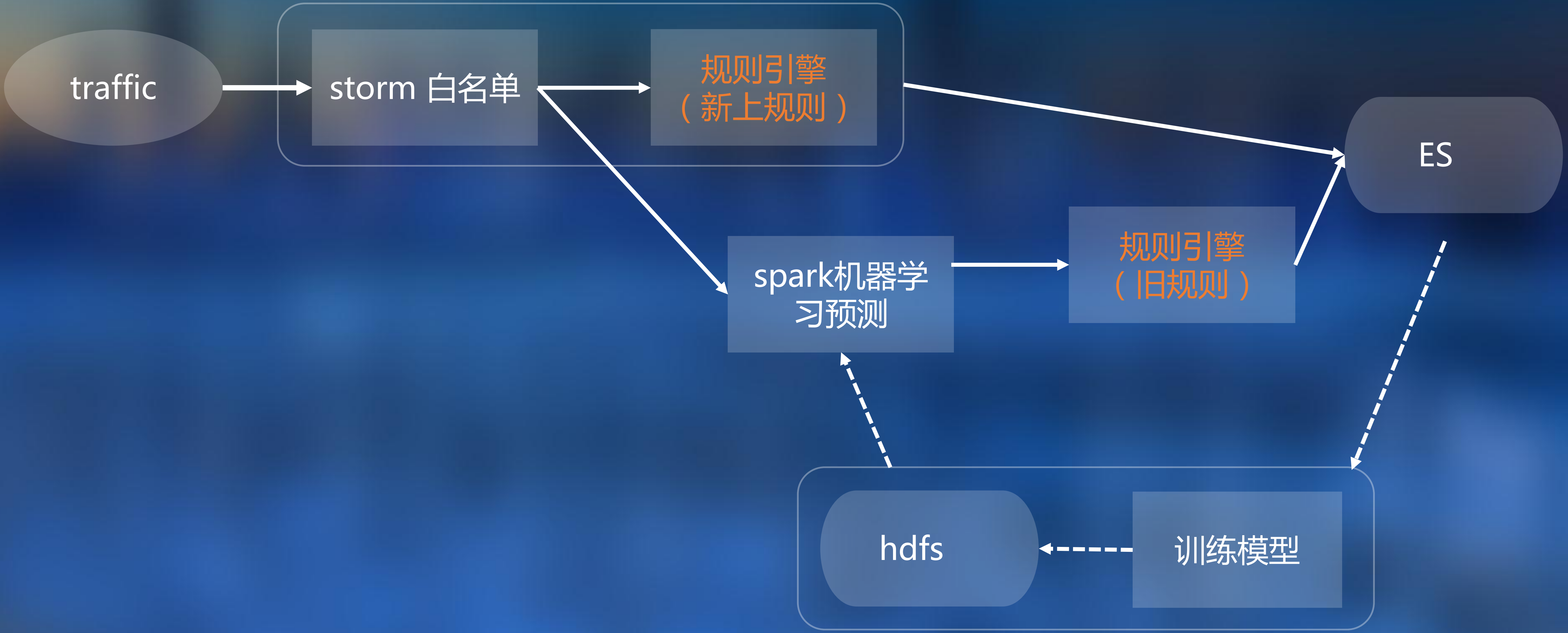
**不足**

如果新上规则的话，
很大概率检测不出来

# 4. 0

- 再次调整架构

# 4.0 -- 架构


traffic
storm 白名单
规则引擎（新上规则）
ES
spark机器学习预测
规则引擎（旧规则）
hdfs
训练模型

# 4. 0

**进步**

可抓新规则定义的攻击

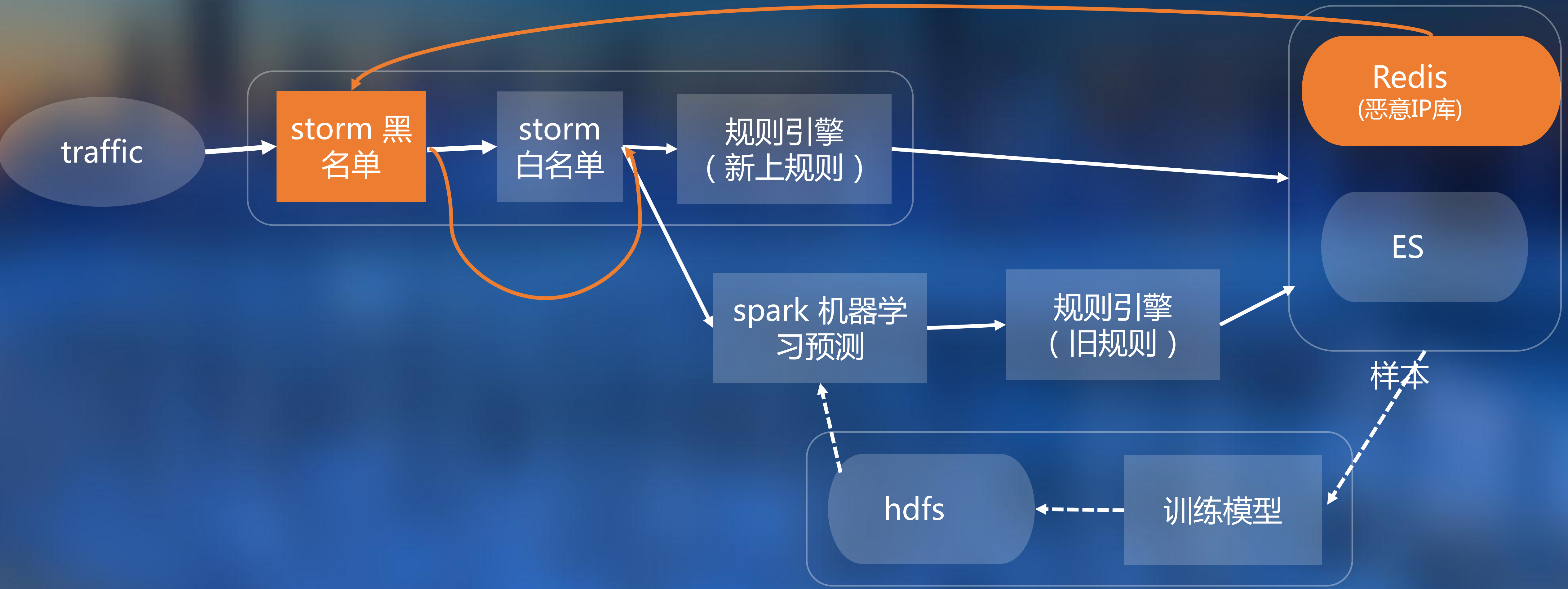
**不足**

无法检测header头

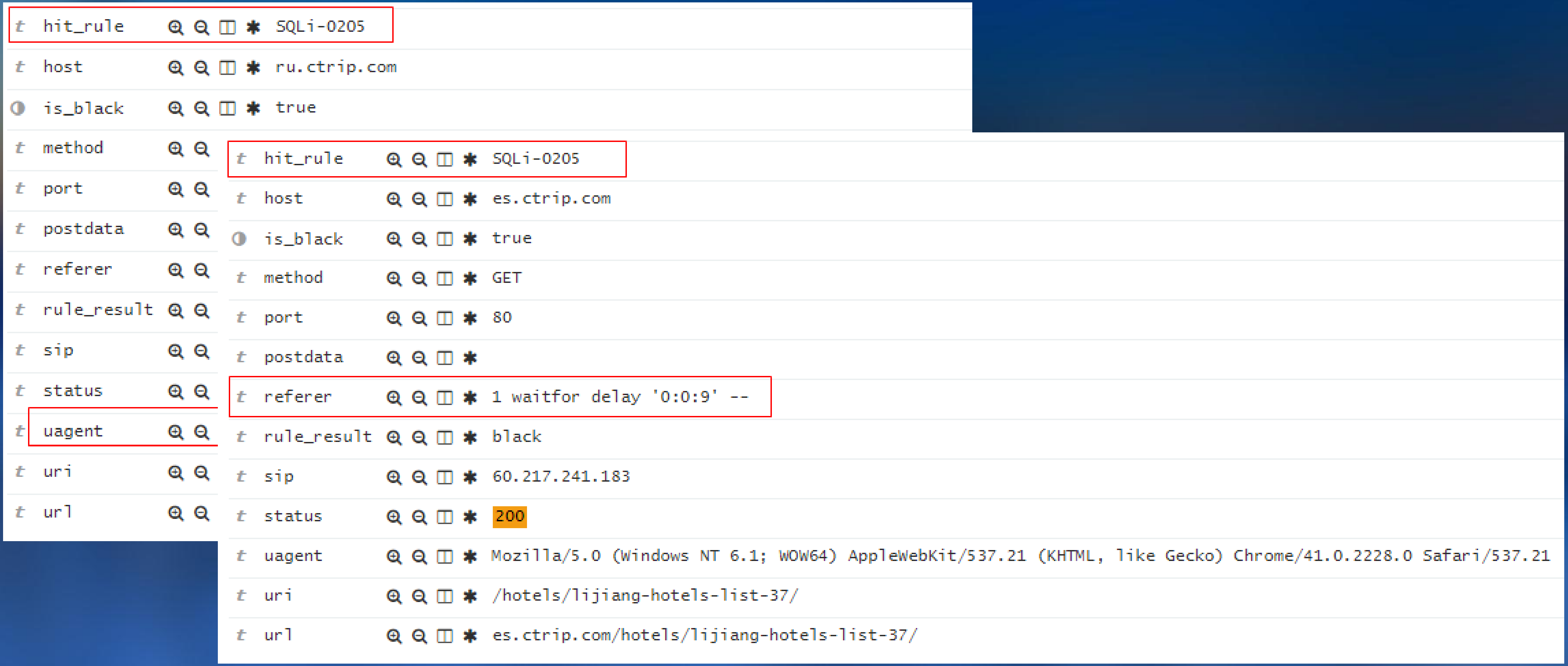
# 5.0

- 增加动态黑名单功能

# 5.0 -- 架构

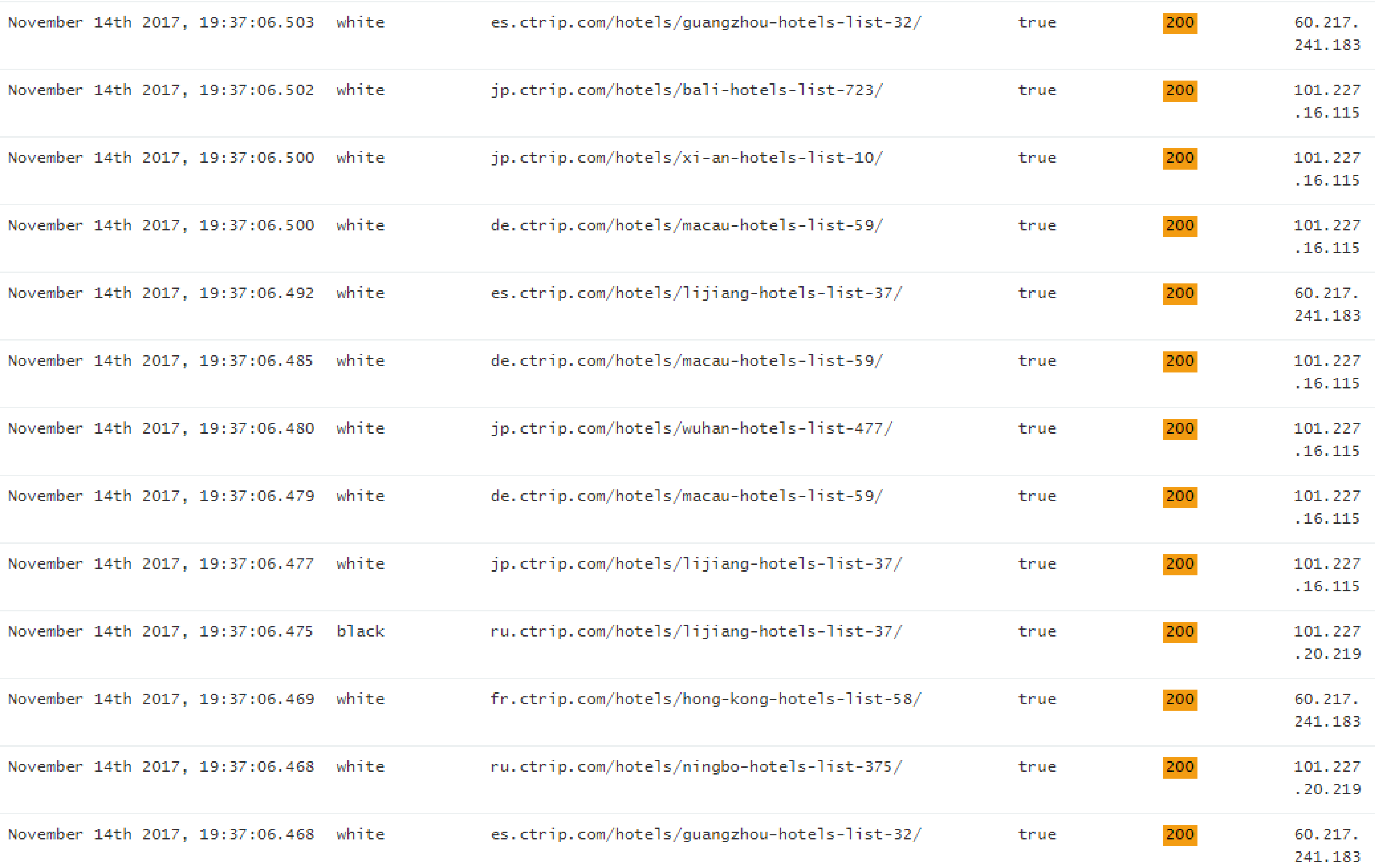

traffic
storm 黑名单
storm 白名单
规则引擎（新上规则）
Redis (恶意IP库)
ES
spark 机器学习预测
规则引擎（旧规则）
样本
hdfs
训练模型

# 5.0 - 效果

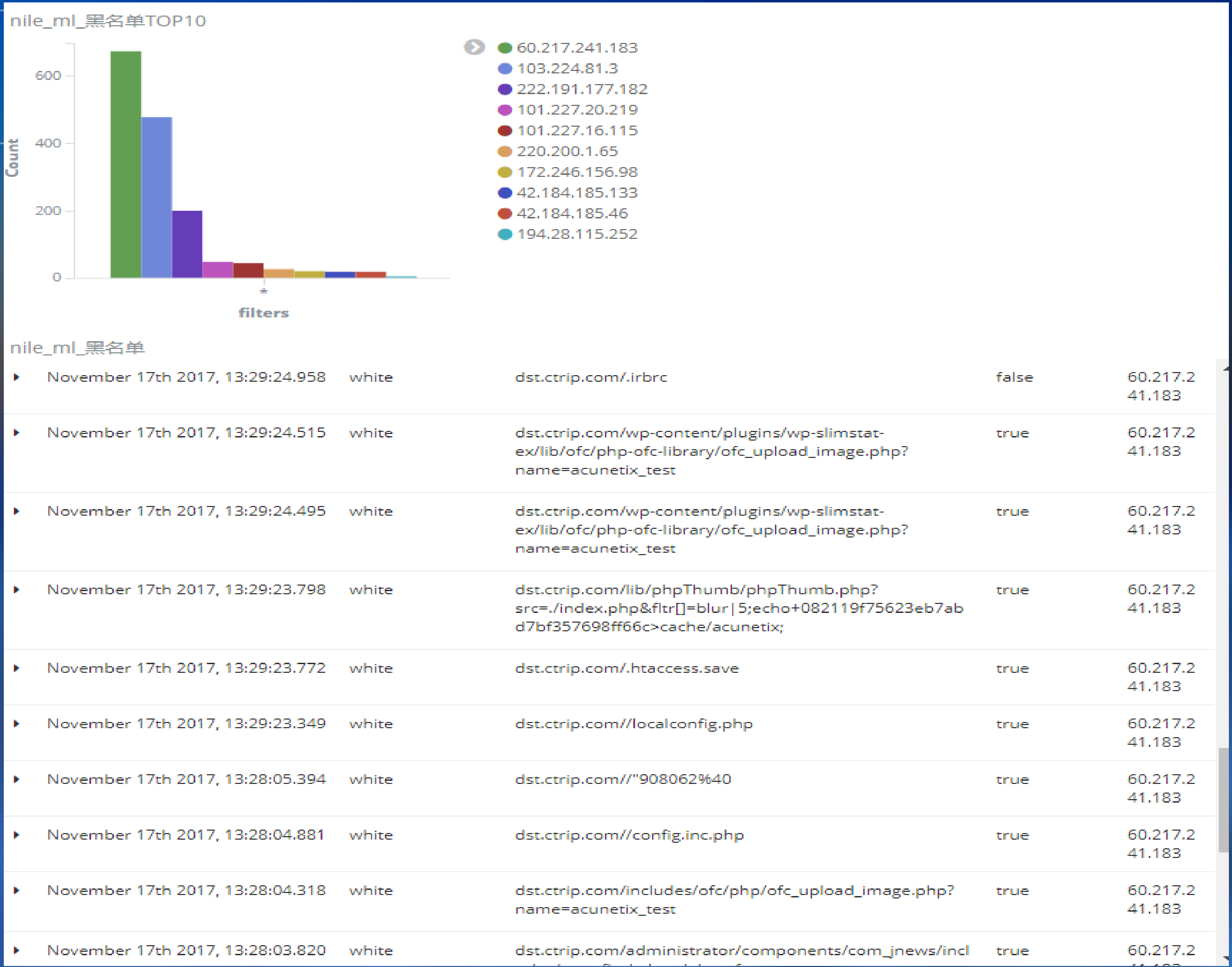


| | |
|---|---|
| hit_rule | SQLi-0205 |
| host | ru.ctrip.com |
| is_black | true |
| method | |
| port | |
| postdata | |
| referer | |
| rule_result | |
| sip | |
| status | |
| uagent | |
| uri | |
| url | |

| | |
|---|---|
| hit_rule | SQLi-0205 |
| host | es.ctrip.com |
| is_black | true |
| method | GET |
| port | 80 |
| postdata | |
| referer | 1 waitfor delay '0:0:9' -- |
| rule_result | black |
| sip | 60.217.241.183 |
| status | 200 |
| uagent | Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.21 (KHTML, like Gecko) Chrome/41.0.2228.0 Safari/537.21 |
| uri | /hotels/lijiang-hotels-list-37/ |
| url | es.ctrip.com/hotels/lijiang-hotels-list-37/ |



| | | | | | |
|---|---|---|---|---|---|
| November 14th 2017, 19:37:06.503 | white | es.ctrip.com/hotels/guangzhou-hotels-list-32/ | true | 200 | 60.217.241.183 |
| November 14th 2017, 19:37:06.502 | white | jp.ctrip.com/hotels/bali-hotels-list-723/ | true | 200 | 101.227.16.115 |
| November 14th 2017, 19:37:06.500 | white | jp.ctrip.com/hotels/xi-an-hotels-list-10/ | true | 200 | 101.227.16.115 |
| November 14th 2017, 19:37:06.500 | white | de.ctrip.com/hotels/macau-hotels-list-59/ | true | 200 | 101.227.16.115 |
| November 14th 2017, 19:37:06.492 | white | es.ctrip.com/hotels/lijiang-hotels-list-37/ | true | 200 | 60.217.241.183 |
| November 14th 2017, 19:37:06.485 | white | de.ctrip.com/hotels/macau-hotels-list-59/ | true | 200 | 101.227.16.115 |
| November 14th 2017, 19:37:06.480 | white | jp.ctrip.com/hotels/wuhan-hotels-list-477/ | true | 200 | 101.227.16.115 |
| November 14th 2017, 19:37:06.479 | white | de.ctrip.com/hotels/macau-hotels-list-59/ | true | 200 | 101.227.16.115 |
| November 14th 2017, 19:37:06.477 | white | jp.ctrip.com/hotels/lijiang-hotels-list-37/ | true | 200 | 101.227.16.115 |
| November 14th 2017, 19:37:06.475 | black | ru.ctrip.com/hotels/lijiang-hotels-list-37/ | true | 200 | 101.227.20.219 |
| November 14th 2017, 19:37:06.469 | white | fr.ctrip.com/hotels/hong-kong-hotels-list-58/ | true | 200 | 60.217.241.183 |
| November 14th 2017, 19:37:06.468 | white | ru.ctrip.com/hotels/ningbo-hotels-list-375/ | true | 200 | 101.227.20.219 |
| November 14th 2017, 19:37:06.468 | white | es.ctrip.com/hotels/guangzhou-hotels-list-32/ | true | 200 | 60.217.241.183 |



nile_ml_黑名单TOP10

nile_ml_黑名单

| | | | | | |
|---|---|---|---|---|---|
| ▸ | November 17th 2017, 13:29:24.958 | white | dst.ctrip.com/.irbrc | false | 60.217.241.183 |
| ▸ | November 17th 2017, 13:29:24.515 | white | dst.ctrip.com/wp-content/plugins/wp-slimstat-ex/lib/ofc/php-ofc-library/ofc_upload_image.php?name=acunetix_test | true | 60.217.241.183 |
| ▸ | November 17th 2017, 13:29:24.495 | white | dst.ctrip.com/wp-content/plugins/wp-slimstat-ex/lib/ofc/php-ofc-library/ofc_upload_image.php?name=acunetix_test | true | 60.217.241.183 |
| ▸ | November 17th 2017, 13:29:23.798 | white | dst.ctrip.com/lib/phpThumb/phpThumb.php?src=./index.php&fltr[]=blur\|5;echo+082119f75623eb7abd7bf357698ff66c>cache/acunetix; | true | 60.217.241.183 |
| ▸ | November 17th 2017, 13:29:23.772 | white | dst.ctrip.com/.htaccess.save | true | 60.217.241.183 |
| ▸ | November 17th 2017, 13:29:23.349 | white | dst.ctrip.com//localconfig.php | true | 60.217.241.183 |
| ▸ | November 17th 2017, 13:28:05.394 | white | dst.ctrip.com//"908062%40 | true | 60.217.241.183 |
| ▸ | November 17th 2017, 13:28:04.881 | white | dst.ctrip.com//config.inc.php | true | 60.217.241.183 |
| ▸ | November 17th 2017, 13:28:04.318 | white | dst.ctrip.com/includes/ofc/php/ofc_upload_image.php?name=acunetix_test | true | 60.217.241.183 |
| ▸ | November 17th 2017, 13:28:03.820 | white | dst.ctrip.com/administrator/components/com_jnews/incl | true | 60.217.2 |

# 5.0

**进步**

更低的漏报
可发现业务逻辑攻击

**不足**

# 未来

## 要解决的问题

- post数据中xml和json格式的数据存在大量误报

## 更智能

- 二分类到多分类
- 使用更多的检测纬度
- 关联各个纬度

## 增加反馈

每周报告效果

# THANKS

更多细节请关注公众号“携程技术中心”，会整理文字版投稿上去