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High Speed Video and Image Processing with Java and Hadoop

Melli Annamalai
Senior Principal Product Manager

Rob Abbott
Big Data Technical Lead

Krishna Kuchimanchi
Hadoop Developer

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Java
Your
(Next)

Safe Harbor Statement

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Growing Volumes of Video and Image Data



Drones



Courtesy: c-span.org



Surveillance cameras



Stock images



Corporate archives

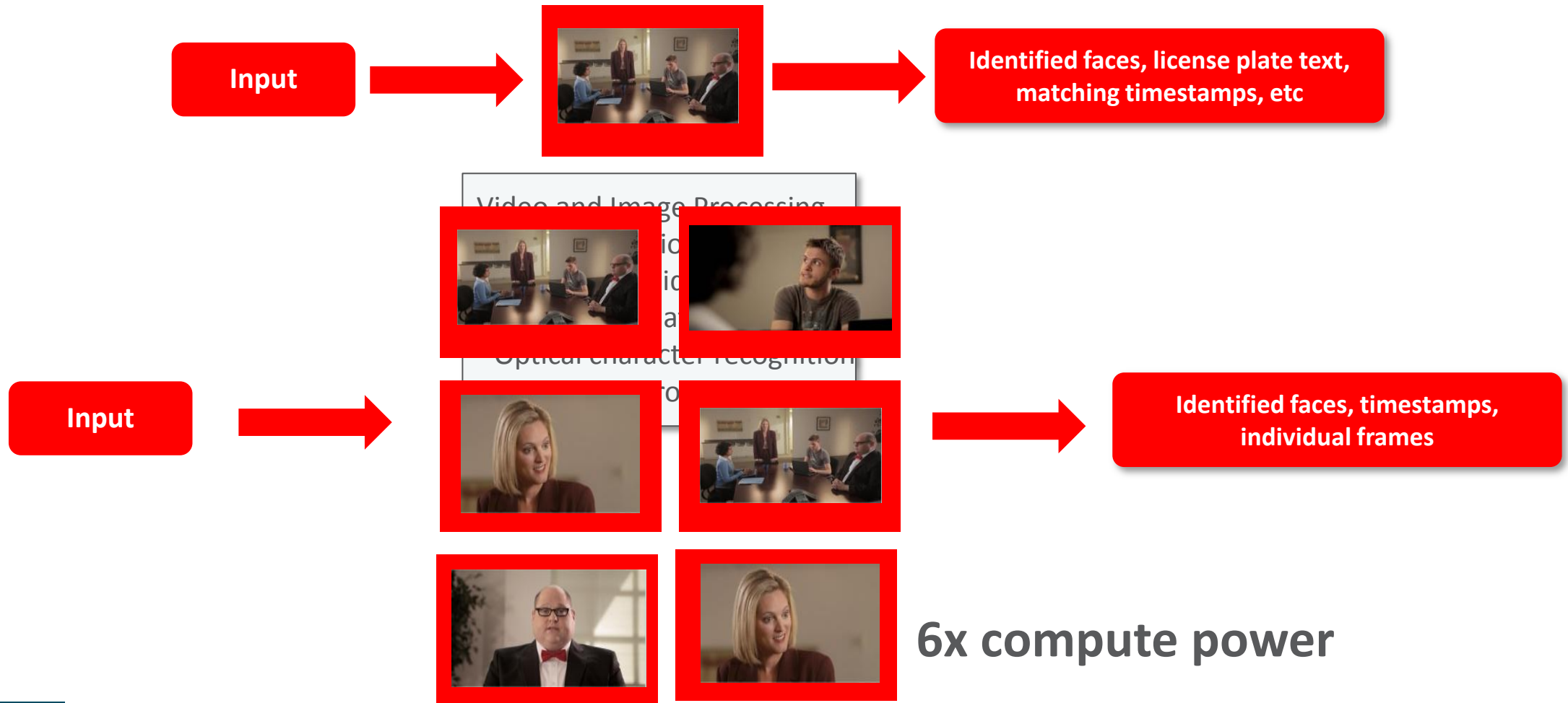


License plates

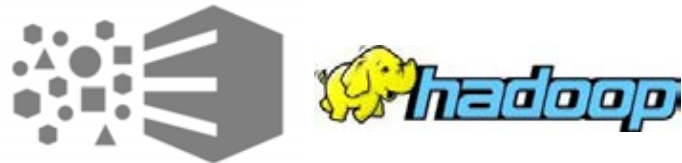
Some Challenges

- Large volumes of data (addressing scale)
- Diversity in types of video/image processing
- Moving video data across the network
(out of the scope of this presentation)

Addressing Scale



Scale-out Capability of Apache Hadoop



**18x compute power
on Oracle Big Data Appliance**

Multimedia Analytics Framework

- Enables processing of video and image data in Hadoop
- Leverages Hadoop parallelism for high speed processing
 - Ships with OpenCV (www.opencv.org)
 - **Integrate third party software into framework**
- Massive storage and InfiniBand network of Oracle Big Data Appliance enables processing and management of petabytes of multimedia data

Part of Oracle Big Data Spatial and Graph

Multimedia Analysis Framework

How it Works

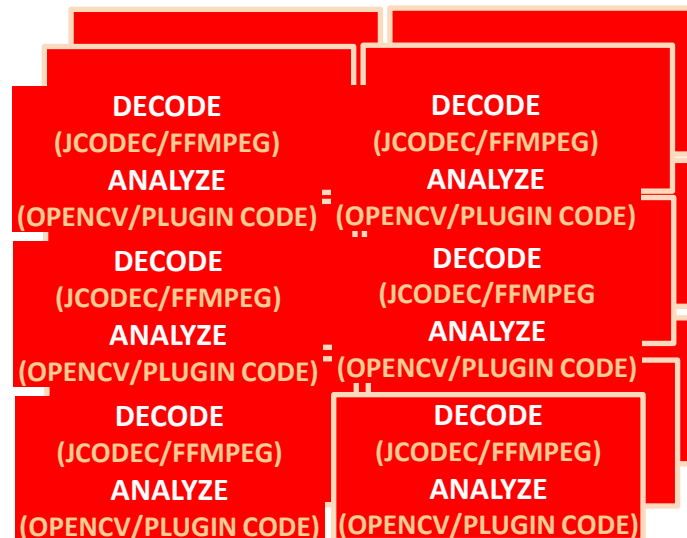


Framework Runs a MapReduce Job

- Submitted as a Hadoop job

```
$ hadoop jar ordhadoop-multimedia-analytics.jar -conf vprocess.xml vinput voutput
```

- Map tasks on each node decode segment of video/image and call `processFrame()`

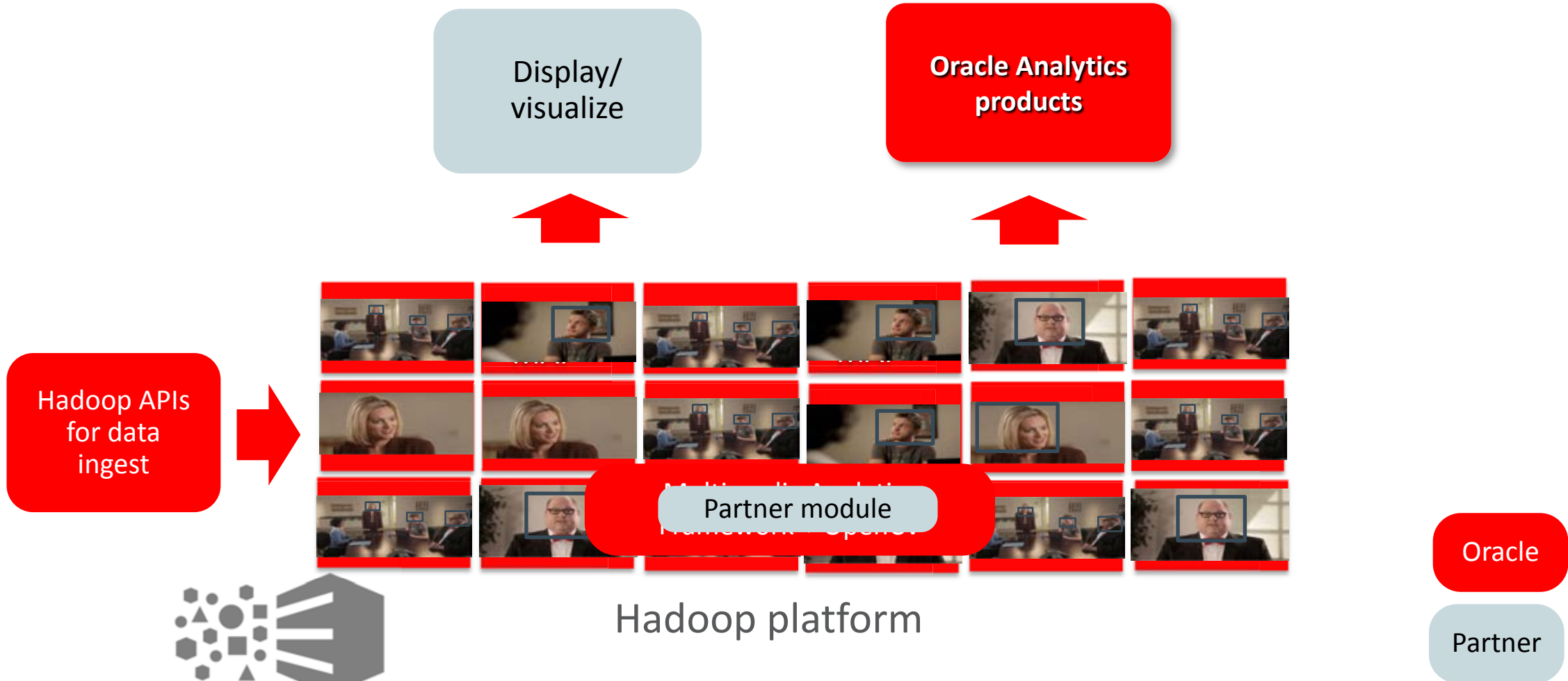


Multimedia Analytics Framework

Benefits

- Faster video processing
 - Processing massive video/image volumes ideal for Hadoop architecture
- Extensible framework
 - Use with a variety of third party video/image processing engines
- Use framework without specialized Hadoop skills
 - Gain Hadoop scalability without Hadoop-specific management and programming skills
- Integrate video/image processing with Big Data applications

Integrate with Video/Image Processing Technology



Extensibility

Address diversity in video/image processing requirements

Extensibility: Implement `processFrame()`

Input: `(key, value (frame from video or image))`

Output: `(key, value)` Defined by implementation

Implement reduce task: For example, group by output key

```
@Override
```

```
    public void processFrame(Text key, OrdImageWritable value)
```

```
@Override
```

```
    public Text getKey()
```

```
@Override
```

```
    public OrdImageWritable getValue()
```

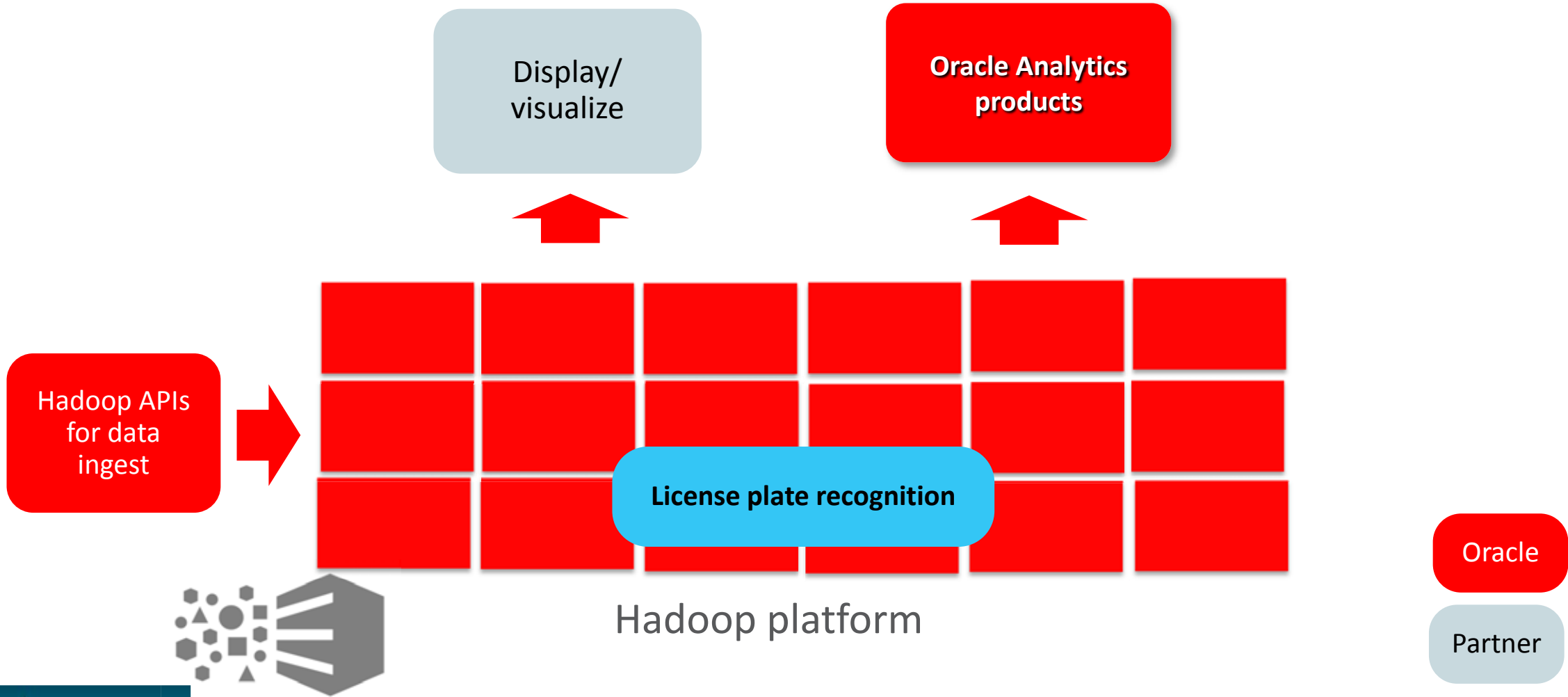
Part of Oracle Big Data Cloud Service



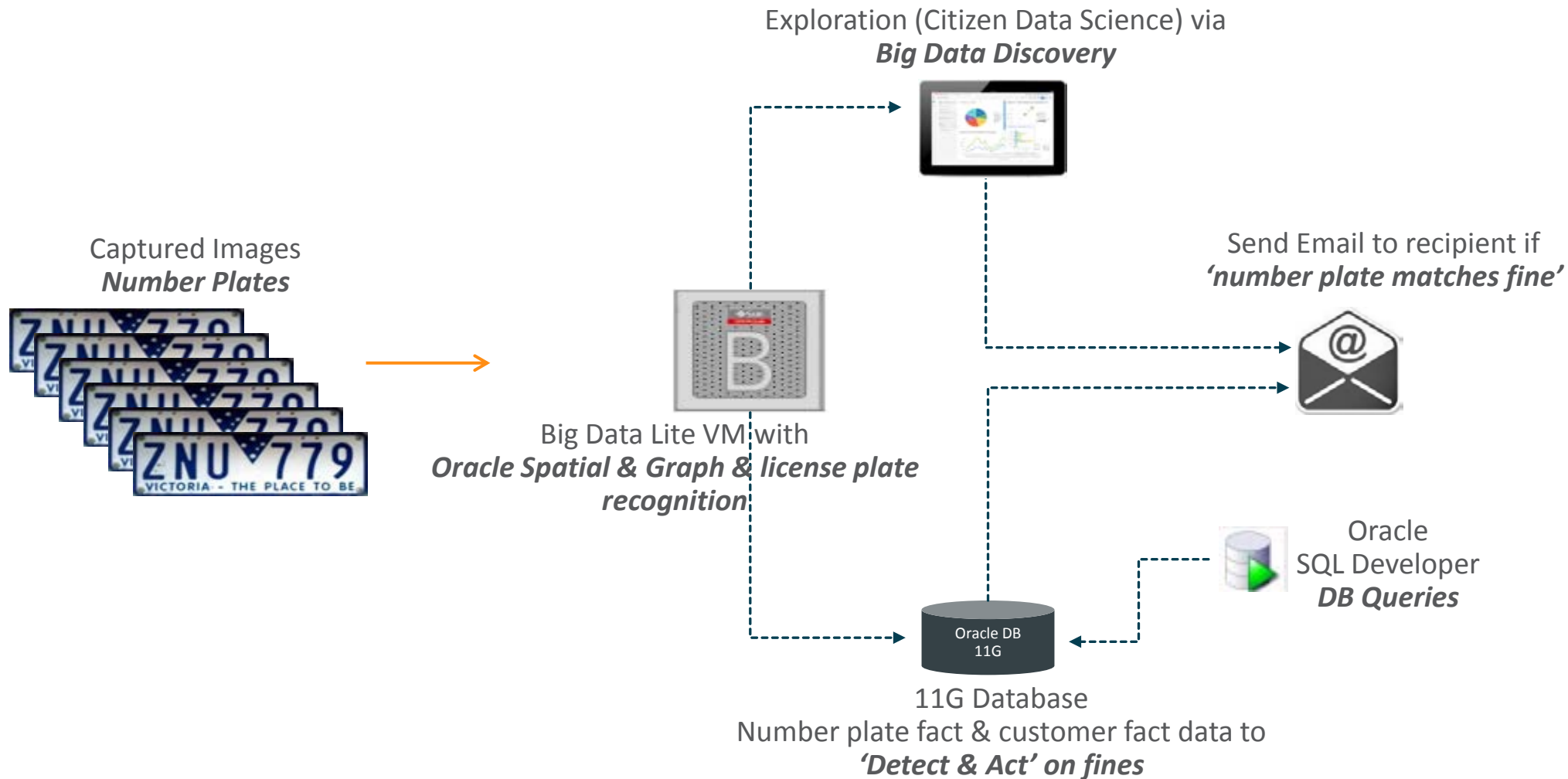
Building Applications

License Plate Recognition

Integrate with Video/Image Processing Technology



Number Plate Demonstration Overview





IMG_1407.JPG



IMG_1408.JPG



IMG_1412.JPG



IMG_1415.JPG



IMG_1416.JPG



IMG_1421.JPG



IMG_1425.JPG



IMG_3715.JPG



```
Displaying output part-m-00000  
hdfs://bigdatalite.localdomain:8020/user/oracle/  
IMG_3755.JPG,1HJ4PR,92.253906
```

```
Script Complete.  
hdfs://bigdatalite.localdomain:8020/user/oracle/  
IMG_3755.JPG,1HJ4PR,92.253906
```

```
hdfs://bigdatalite.localdomain:8020/user/oracle/  
IMG_3715.JPG,ZHT855,89.887215  
IMG_3715.JPG,2HT855,81.972366  
IMG_3715.JPG,ZHT855,78.273483  
IMG_3715.JPG,ZHT855,76.112907  
IMG_3715.JPG,ZHT85,74.122231
```

```
hdfs://bigdatalite.localdomain:8020/user/oracle/  
IMG_3757.JPG,1AV8QN,90.708931  
IMG_3757.JPG,1AV80N,84.348106  
IMG_3757.JPG,1AV8N,79.394325  
IMG_3757.JPG,1AV8GN,79.057892  
IMG_3757.JPG,1AV8QM,78.712296
```

```
hdfs://bigdatalite.localdomain:8020/user/oracle/  
IMG_3756.JPG,1FL3SN,90.684166  
IMG_3756.JPG,1FL3SM,80.105354  
IMG_3756.JPG,1FL3S,76.760109
```

```
hdfs://bigdatalite.localdomain:8020/user/oracle/  
IMG_3758.JPG,ZTY805,87.072441  
IMG_3758.JPG,2TY805,84.029678  
IMG_3758.JPG,ZTY05,78.346504  
IMG_3758.JPG,ZTYS05,76.793304  
IMG_3758.JPG,ZTY8Q5,76.443649
```

```
hdfs://bigdatalite.localdomain:8020/user/oracle/  
IMG_3759.JPG,U0T981,90.703484
```



[Fine on car: YDU759 ...](#)
[Violation Analysis | N...](#)

localhost:9003/bdd/web/anz/new-page?p_p_id=endecatagcloudportlet_INSTANCE_K6yp&p_p_lifecycle=t

[Most Visited](#)
[Hue](#)
[MoviePlex](#)
[Hadoop](#)
[Spatial and Graph](#)
[BDD](#)
[Apex](#)
[ORDS Lab](#)
[Solr Admin](#)
[SQL Pattern Matching](#)
[Cloudera Manager](#)
[RStudio](#)

ORACLE Big Data Discover

Discover;
Create persistent visualizations of your data for analysis and sharing with others

Explore ▾ Transform ▾ Discover ▾ **Number Plate Demo: Violation Analysis**

SPEED	Σ
STATE	ϕ
STATE	ϕ
TimeOfDay	ϕ
VEHICLE_CLASS	ϕ
WHEELBASE	Σ
ZIPCODE	Σ

Hide Preview Last preview: 2016-09-15 03:43

1BA6BD 1ZI4IX 2A15BS **2LO4QS** 2NN1ZB 2OR3HW 2TO5EW 2VD2LQ 2VJ9VS
2ZR8CM 3CK5ZD 3HW6XT 3NH1RG 3QJ6CG 3SQ7VK AZP854 BAQ023 BHC232
DCQ574 DDC855 ENT447 **EPH106** ETD483 FD96ZV FYQ423
 GRW438 HA89SO HHP573 **HHX340** JIB667 JKP948 JON961 LHE493
 MX19MW NES775 OJ77AO **RFY940** SAI747 SC39PO SE73YR
 TAR694 **TCK394** VCE625 WOH092 WSO581 **YDU759** YUH093
 YXB791 ZG91NP ZZW555

Explore PLATE_NUMBER by SPEED (sum)

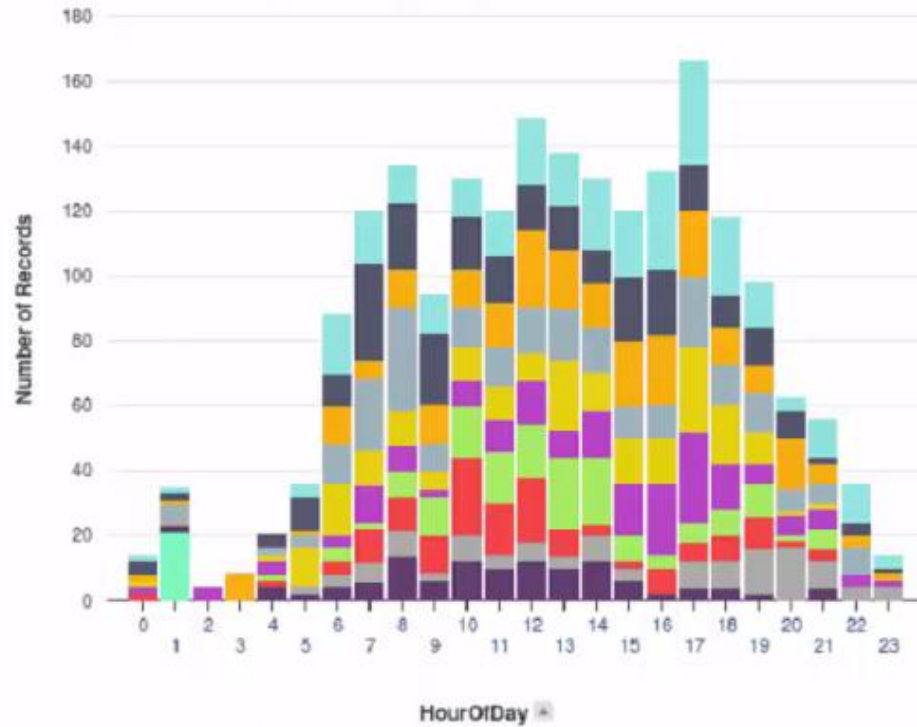


Explore Transform Discover **Number Plate Demo: Violation Analysis**

COLUMN CONTAINER

CHART

Location wise Violation Trend



FINES DISCOVERED

0 RECORDS SELECTED

VIEW OPTIONS ACTIONS

<input type="checkbox"/>	PLATE_NO: YDU759 ZIPCODE: 3006	OWNERNAME: Sean Rogers STATE: Victoria FINE_DATE: 8/19/16	Record detail
<input type="checkbox"/>	PLATE_NO: 1HN7PE ZIPCODE: 3816	...more STATE: Victoria FINE_DATE: 8/19/16	Record detail
<input type="checkbox"/>	PLATE_NO: YMN672 ZIPCODE: 3188	OWNERNAME: Norma Green STATE: Victoria FINE_DATE: 8/19/16	Record detail
<input type="checkbox"/>	PLATE_NO: XZJ276 ZIPCODE: 3910	...more STATE: Victoria FINE_DATE: 8/19/16	Record detail
<input type="checkbox"/>	PLATE_NO: XZZ105	FINE_DATE: 8/19/16	Record detail
<input type="checkbox"/>	PLATE_NO: 1GP9HA	OWNERNAME: Annie ...more STATE: Victoria	

PAGE 1 OF 1 1-6 OF 6

Violation Analysis



Optical Character Recognition

With Apache Tesseract

Implement OCR processing in `processFrame()`

Input: `(key, value (frame from video or image))`

Output: `(key, value)` **Output value image overlaid with recognized text**

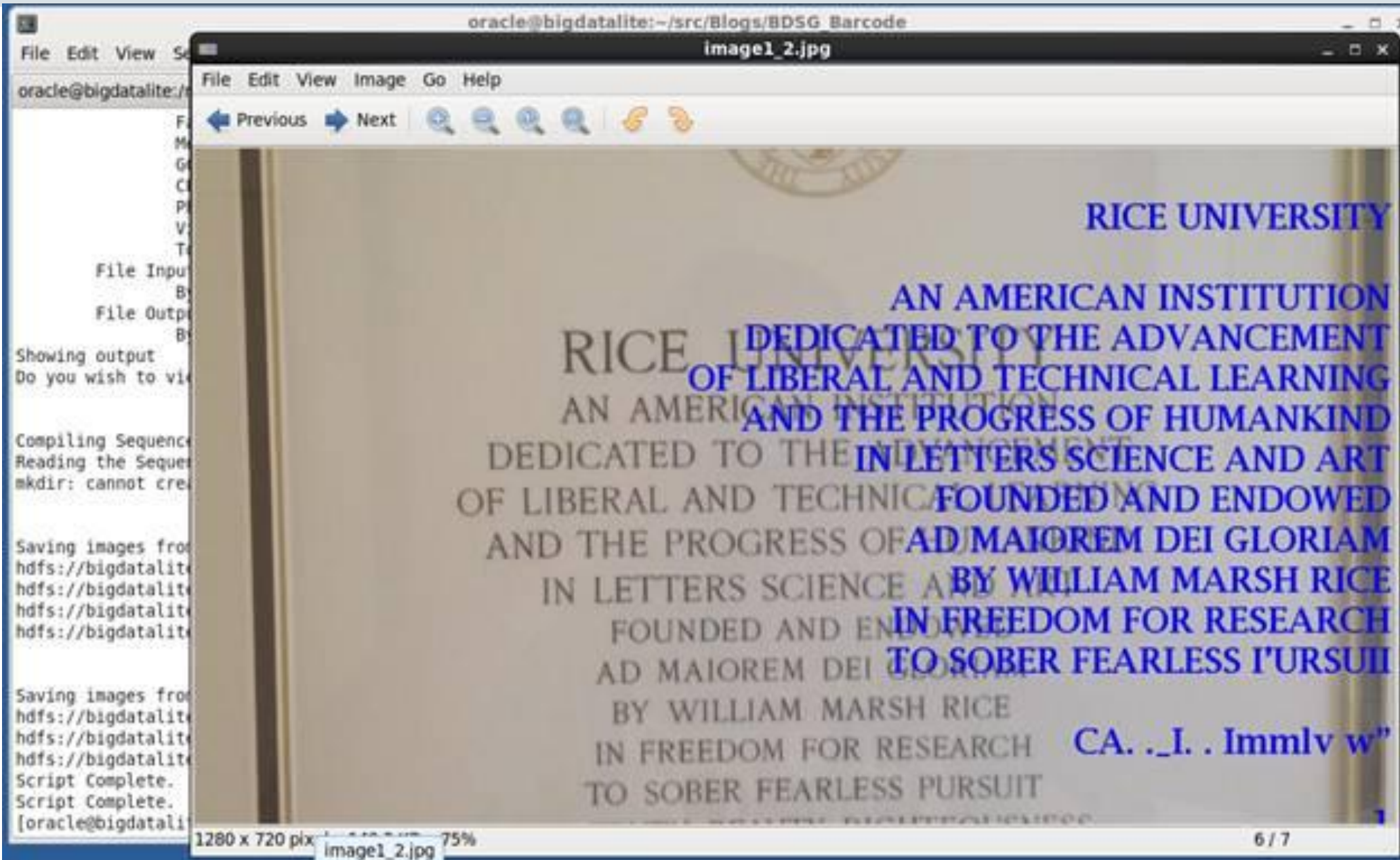
@Override

```
public void processFrame(Text key, OrdImageWritable value) {
```

```
    <call Tesseract APIs>
```

```
    ocrString = instance.doOCR()
```

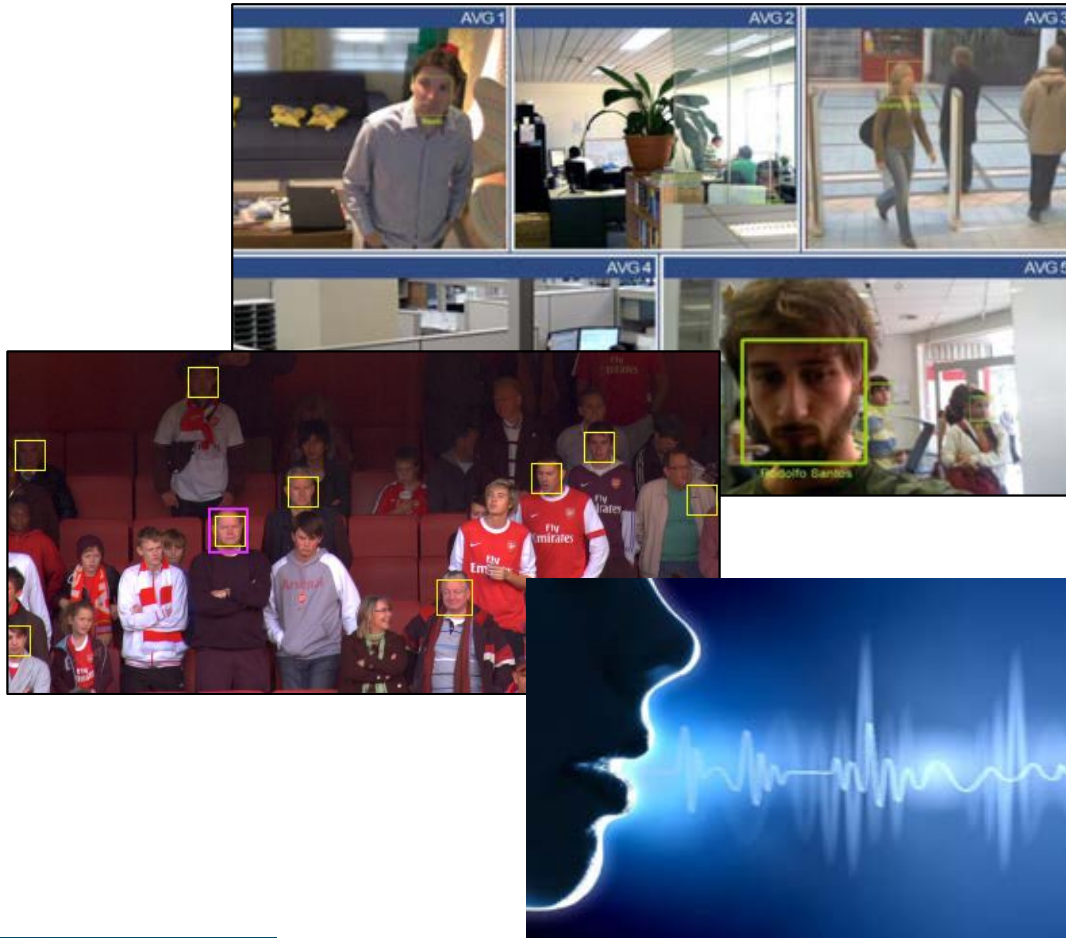
Details in https://blogs.oracle.com/bigdataspatialgraph/entry/using_oracle_big_data_spatial



Partnership with Griaule

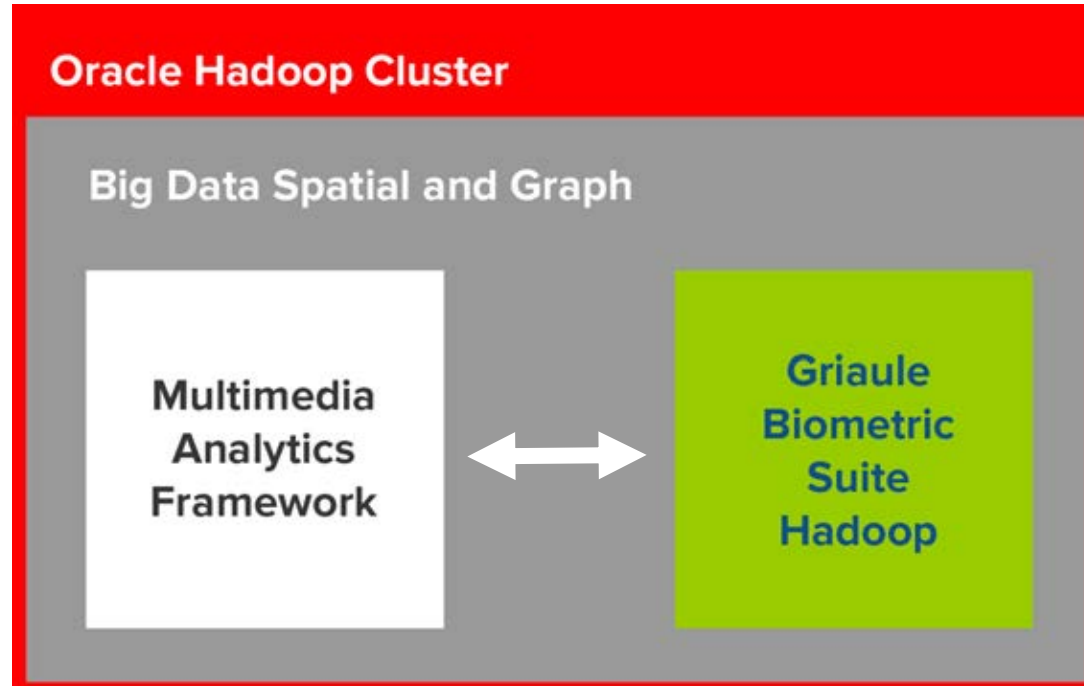
- Specialized in software for large scale biometric identification systems (Big Data Biometrics)
- Provides technology for Systems Integrators who provide solutions to the end customer
- 15 years researching biometrics, with over 20 certifications (FBI, NIST, FVC, etc.)
- Largest ABIS in the world using fingerprint as primary technology for deduplication
- Multimodal fingerprint, face and voice technologies

Identification Uses



- Recognize people amid crowds
- Facial aging and weight changes
- Over 20 FBI certifications in biometrics
- Most precise finger print algorithm in the world since the FVC2006

Architecture



- Easily integrated
- Plan to integrate with all Griaule's identification systems (facial, voice, fingerprint and more)
- Full access to Griaule's intelligence systems

Implement Griaule processing in `processFrame()`

Input: `(key, value (frame from video or image))`

Output: `(key, value)` **Output value face with green or yellow bounding box**

```
@Override
```

```
public void processFrame(Text key, OrdImageWritable value) {
```


Demo



Roadmap

- Real-time analysis of streaming video
- Spark streaming integration

Summary

- Multimedia Analytics Frameworks enables fast video and image processing in Hadoop
- Extensibility API for third party software integration enables many different types of processing
- Video and image data can be analyzed along side other Big Data types

Integrated Cloud

Applications & Platform Services



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