Visual Recognition

VisRec JSR
Expert Group - Introduction

Zoran Severac - DeepNetts
Researcher at AI Lab, Dept for Software Eng, Univ of Belgrade, Serbia
Founder of Java Neural Network Open Source Project
Java Champion, NetBeans Dream Team

Sandhya Kapoor - IBM
Senior Technologist - IBM Cognitive Computing
AI and Deep Learning

Frank Greco - Crossroads Technologies
Java Champion, NYJavaSIG Chairman
Enterprise and Cloud Architect
Summary Statement

To simplify and standardize Java APIs for detecting, recognizing and annotating images.
Importance of Machine Learning

Forbes: Machine Learning Is Revolutionizing Sales and Marketing

- 76% of companies say they are targeting higher sales growth with machine learning
- At least 40% of companies surveyed are already using machine learning to improve sales and marketing performance
- 38% credited machine learning for improvements in sales performance metrics

Machine Learning is generating growth and driving innovation
Visual Recognition

Machine Learning Is Redefining The Enterprise In 2016

Bottom line: Machine learning is providing the needed algorithms, applications, and frameworks to bring greater predictive accuracy and value to enterprises' data, leading to diverse company-wide strategies succeeding faster and more profitably than before.

Industries Where Machine Learning Is Making An Impact

The good news for businesses is that all the data they have been saving for years can now be turned into a competitive advantage and lead to strategic goals being accomplished. Revenue teams are using machine learning to optimize promotions, compensation and rebates drive the desired behavior across selling channels. Predicting propensity to buy across all channels, making personalized recommendations to customers, forecasting long-term customer loyalty and anticipating potential credit risks of suppliers and buyers are Figure 1 provides an overview of machine learning applications by industry.
Why is this important for Java?

- Machine Learning is a huge industry trend
- Wide business implications for all applications across devices for many years
- Visual Recognition (VisRec) is an important subset of ML
- Java needs to play a major role in both VisRec and ML
What do Java Developers Need?

- A standard, easy-to-use and flexible set of high-level VisRec APIs
- Well-defined APIs essential for robust system architecture
- Ease of development and portability
- High-level abstractions for sustainable development of products and protect developers from lower-level changes (with hooks allowing lower-level access)
- Building *custom* Image Classifiers (not just using pre-trained Classifiers)
Existing Solutions?

- Existing Frameworks, Packages and Libraries
  - OpenCV, BoofCV, OpenIMAJ, ImageJ, DeepLearning4J, Weka, RapidMiner, etc...

- Existing Services and Engines
  - IBM Visual Recognition (Watson)
  - Google Cloud Vision (TensorFlow)
  - AWS Recognition (Deep Learning)
  - Microsoft Computer Vision
Issues with Existing Offerings

- Wide, disparate collection of open-source and proprietary ML engines, toolkits and packages
- Using different image classes, different algorithms and implementations, very often with native dependencies
- Each has its own set of APIs
- Reduced Portability for Image Recognition Apps
- Reduced Portability for lower-level Bitmap, Image, etc, pixel-level manipulation
- Some Toolkits are very complex for Average Java Developer
Our Plan

● Technical Strategy
  - Classification, ML Workflow and Evaluation
    - Machine Learning Layer
      - Detection
      - Recognition
      - Annotation
    - Visual Task Layer
      - Implementation of the high level visual recognition tasks
    - Implementation layer

● Transparency
  - Email list - google group
Example usage

Building an image classifier

```java
Classifier imageClassifier = new Dl4jImageClassifier();
Properties prop = new Properties();
prop.put("imagesPath", "/home/zoran/animals");
prop.put("imageWidth", "100");
prop.put("imageHeight", "100");
imageClassifier.buildClassifier(prop);
```

Using the image classifier

```java
ImageRecognitionResults results = imageClassifier.classify(new File("00060.png"));

for(ImageRecognitionResult result : results) {
    System.out.println(result);
}
```
## Status of Implementations

- **Reference Implementations** - DeepLearning4J, DeepNetts
- **Working Implementations** - Watson Visual Recognition Service

<table>
<thead>
<tr>
<th>Interfaces</th>
<th>Classifier, Detector, Recognizer, Annotator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract classes</td>
<td>ImageRecognitionProvider</td>
</tr>
<tr>
<td>Utility</td>
<td>ImageFactory</td>
</tr>
</tbody>
</table>
## Tentative Schedule

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>JSR submittal</td>
<td>March 2017</td>
</tr>
<tr>
<td>Early Draft Review</td>
<td>August 2017</td>
</tr>
<tr>
<td>Public Draft Review</td>
<td>November 2017</td>
</tr>
<tr>
<td>Proposed Final Draft</td>
<td>March 2018</td>
</tr>
<tr>
<td>Final Approval Ballot</td>
<td>April 2018</td>
</tr>
</tbody>
</table>
Sponsors and Advisors

IBM

Ed Burns - Oracle

Guillaume LaForge - Google

Jim Weaver - Pivotal