

Multimedia Indexation using Deep Learning in Big Data (MIDL)

Abstract:

The goal of this project is to develop a cloud platform for indexing large-scale images by the content using the technique of Big Data such as Hadoop, Spark, etc. The techniques of Machine and Deep Learning will be used for improving the accuracy of learning and retrieval phases. Within our platform, the user can provide the query image, the result will be presented by a set of similar images (Top-20 similar images). The platform can also index the query image if the user is not satisfied in order to improve more the precision.

Keywords: Big Data, Hadoop, Spark, Deep Learning, Hipi, Query image.

I. Principal investigator :

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- Ir. Mohammed Amin BELARBI, Faculty of exact science and computer science, University of Mostaganem. Algeria.

II. Candidates :

- Ir. Sohaib, Larbaa, Numédiart Institute, University of Mons. Belgium.
- Pr. Saïd Mahmoudi, Faculty of Engineering, University of Mons. Belgium.
- Ir. Mohammed El ADOUI, Faculty of Engineering, University of Mons. Belgium.

III. Project Objectives: within eINTERFACE'18 workshop, we would like to improve and develop four main tools for our platform:

1. Since our platform employs classic image features such as SIFT [1] SURF [2], Color histogram [3], etc. Our next crucial approach is the integration and exploitation of Deep Learning algorithms for images features extraction and learning such as YOLO [4], which is used for object detection in real time, CNN features provided from Alexnet model, CaffeNet Library. The idea is to provide to users different features (classic or based on Deep Learning). After that, users can select the convenient

feature and get the results of his query images. The recall and precision curves will be provided in order evaluate the system.

2. The next step is the integration of Hadoop [5] or Spark frameworks in order to have a parallel and distributed storage and treatment of large-scale images features. In this step, we will try to use the HIPI [6] (Hadoop image processing interface) framework since our platform is using the image processing algorithms. Indeed, HIPI is an image processing library designed to be used with the Apache Hadoop MapReduce parallel programming framework.
3. After the finalization of the previous steps, we will try to exploit high performance hardware (GPUs) in the cloud in order to offer fast treatments and easier exploitation of our method. The exploitation of the GPUs [7] [8] [9] will be used for executing Machine and Deep Learning descriptors. This exploitation will be adapted the HIPI framework in order to provide parallel and distributed treatment.
4. The final step is the amelioration and improvement of our platform by the integration of several options that offers more flexibly to users such as introducing the query image from webcam or from a drawing, etc.

IV. Background information:

a) CBIR system :

A content-based image retrieval system is a computer system for browsing, searching and retrieving images from a large database of digital images. Several research works have been done in this area for the domains of commerce, government, academia, and hospitals where large collections of digital images are being created. Many of these collections are the product of digitizing existing collections of analogue photographs, diagrams, drawings, paintings, and prints. Usually, the only way of searching these collections was by keyword indexing, or simply by browsing. Digital images databases however, open the way to content-based searching [10]. Fig 1 show the general architecture of CBIR system.

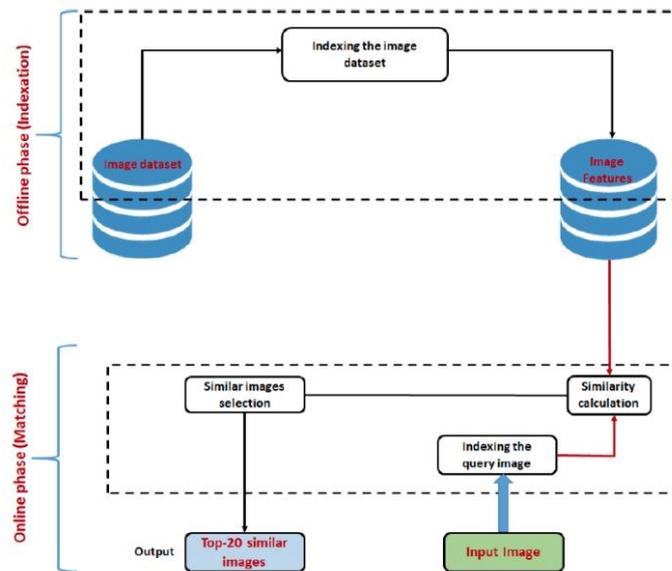


Figure 1 : The general architecture of CBIR system

b) Hadoop Image Processing Interface (HIPI) :

HIPI is an image processing library designed to be used with the Apache Hadoop MapReduce parallel programming framework. On the one hand, HIPI allows efficient and high-throughput image processing with MapReduce style parallel programs typically executed on clusters. It provides a solution for storing large collection of images on the Hadoop Distributed File System (HDFS) and makes them available for efficient distributed processing. On the other hand, HIPI integrates the OpenCV module, a popular open-source library that contains many computer vision algorithms [6]. The general presentation of a program that use MapReduce/HIPI frameworks is shown in Fig 3.

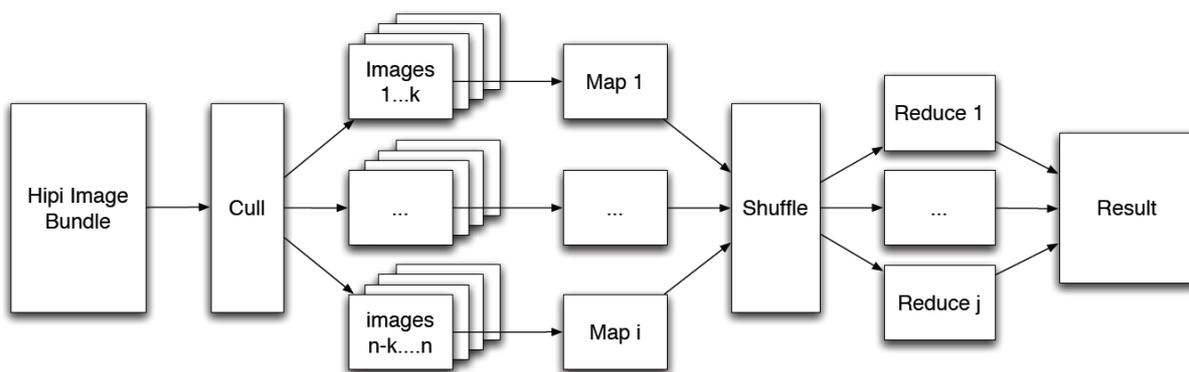


Figure 2 : The organization of a typical MapReduce/HIPI framework [6]

c) YOLO : YOLO is a real-time object recognition algorithm proposed in the entitled “You Only Look Once: Unified, Real-Time Object Detection” , by Joseph Redmon, Santosh

Divvala, Ross Girshick, Ali Farhadi [4]. The open-source code, called darknet, is a neural network framework written in C and CUDA. This algorithm applies one single neuronal network (NN) to the full image. The NN divides the image into several regions in order to predict probabilities and weights for each region (Fig. 3).

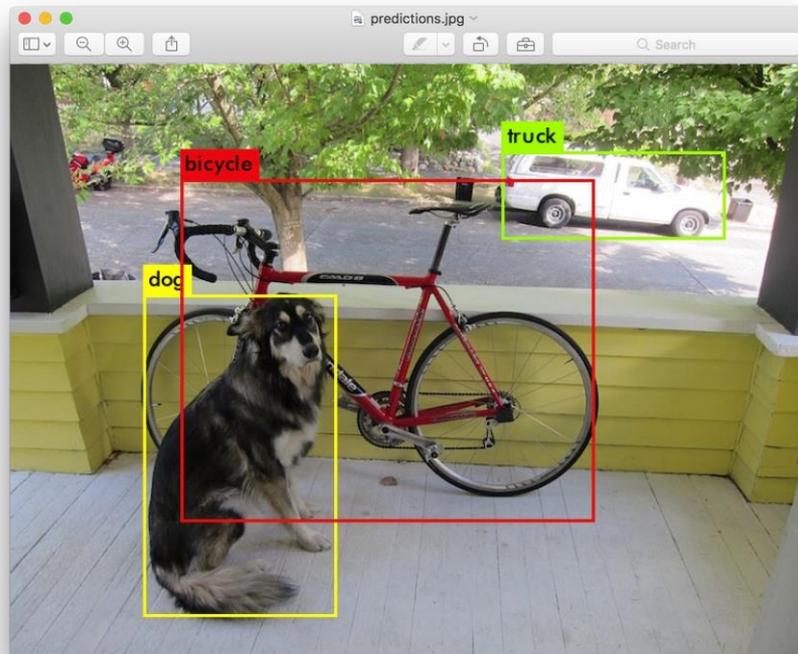


Figure 3 : Objects detections with YOLO algorithm [4]

V. Project objectives: the technical description of our work can be presented by three work packages:

a) Work Package 1: Deep learning features within Big Data

- Integration and exploitation of Deep Learning algorithms for images features extraction and learning.
- Integration of Hadoop or Spark frameworks, in order to have a parallel and distributed storage and treatment of large-scale images features.

b) Work Package 2: GPU and cloud-based high-performance computing

- Exploitation of high performance hardware (GPUs) [11] [12] within virtual machines (in the cloud) in order to offer fast treatments and easier exploitation of our method.

c) Work package 3: Results validation

- Results validation and performance evaluation by the use of several large-scale type of images (faces, cars, specific objects, medical images, etc.)

VI. Profile team

➤ Team leader :

- The project leader is Sidi Ahmed Mahmoudi, which received the graduate engineering degree in computer science from the University of Tlemcen, Algeria, the master degree in multimedia processing from the Faculty of Engineering in Tours, France, and the PhD degree from the University of Mons, Belgium, in 2006, 2008, and 2013, respectively. Currently, He is working as PhD research associate at the University of Mons, Belgium. My research interests are focused on the efficient exploitation of local and cloud computing resources (multi-CPU/ multi-GPU) architectures for multimedia processing and machine learning algorithms within Big Data volumes. Sidi Ahmed Mahmoudi has participated in several national (ARC-OLIMP, Numédiart, Slowdio, Comptoux, CLEO and FEDER IDEES) projects and European actions (COST IC 805 and COST NESUS IC1305). He is author or co-author in more than 50 international publications.

➤ Staff proposed by the leader :

- Mohammed Amin BELARBI is PhD Student from the Mathematics department, Faculty of Exact Sciences and Computer Science, University of Mostaganem, Algeria and from computer science department, Faculty of Engineering, University of Mons, He started his PhD the in University of Mostaganem, Algeria and University of Mons in 2014 (Co Tutelle). He holds a master's degree in engineering information system in 2013 and Computer Science degree in 2011 from University of Mostaganem. His research interests are Multimedia Retrieval, Indexing videos and images. Mohammed Amin BELARBI has participated in previous edition of eINTERFACE workshops (2016, 2017).

- Mohammed EL ADOUI received the Master degree in computer science (computer graphics and Image processing) from the University of Moulay Abdellah in Fez, Morocco, in 2015, and the basic license degree in Mathematics and Computer science from the Faculty of Science in Oujda, Morocco in 2013. Currently, he is a PhD student at the University of Mons, Belgium. His PhD that started in December 2015, is focused on Quantifying Tumor Vascular heterogeneity of breast cancer, using Dynamic Contrast-Enhanced Magnetic Resonance Imaging (DCE_MRI).

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