The ISC Int'l Journal of Information Security
ISeCure

November 2020, Volume 12, Number 3 (pp. 1–5)
http://www.isecure-journal.org

Selected Paper at the ICCMIT'20 in Athens, Greece

The Use of Local Sensitive Hashing for E-learner Face Identification**

Hachem H. Alaoui [1,*], Elkaber Hachem [1], Cherif Ziti [1], and Mohammed Karim [2]

[1] *Mathematics & Computer Department, Faculty of Sciences, Moulay Ismail University, Meknes, Morocco.*
[2] *LISTA Laboratory Faculty of sciences Dhar El Mahraz, Sidi Mohamed Ben Abdellah Unversity, Fs, Morocco.*

ARTICLE INFO.

Keywords:
Cloud, Facial Image, J48, Learning Platform, LSH, Profile

Type: Research Article

doi: 10.22042/ISECURE.2021.271051.612

ABSTRACT

Because face can reveals much hidden information, we need to interpret these data and benefit from them. Hence, our paper shows a new and productive facial image representation based on local sensitive hashing (LSH). This strategy makes it conceivable to recognize the students who pursue their preparation in our learning training; during every session an image of the learner will be taken by the webcam to be compared to that already stored in the database. As soon as the learner is recognized, he/she must be arranged in the accordion to an appropriate profile that takes into consideration his/her weaknesses and strength, which is conducted with the help of the J48 as a predictive study. Furthermore,we utilize a light processing module on the client device with a compact code in order that we can have a lot of information transmission capable to send the component over the network, and to have the option to record many photos in an enormous database in the cloud.

1 Introduction

Automatic face analysis has become a very active research topic especially in the field of computer vision research. This analysis contains, for example, face detection, facial recognition and facial features. An essential challenge in facial analysis is finding competent descriptors for facial appearance [1].
Different holistic methods have been widely studied, such as principal component analysis (PCA) [2], linear discriminate analysis (LDA) [3], and 2D ACP [4]. Also local descriptors have received increased attention due to their strength in the face of challenges such as "pose" and "lighting changes" when taking the picture.
This article proposes an approach of the identification of students based on clouds, with Hashing Local-Sensitive. In addition, next-generation cellular networks, with their high rate of diffusion and energy expertise, provide an innovative methodology for wireless multimedia communications that joins digital technologies and wireless communications to ensure quality of service.
Even though it is very instinctive to humans, automatic learner identification is still extremely challenging due to [5]:

i) The need and ambiguity of accessible annota-

* Corresponding author.
**The ICCMIT'20 program committee effort is highly acknowledged for reviewing this paper.
Email addresses: mh.alaouiharouni@uiz.ac.ma, hachem.elkaber@gmail.com, chziti@gmail.com, mohammed.karim@usmba.ac.ma
ISSN: 2008-2045

tions;

ii) Other factors, such as light, look, etc., influence the way that a face is shown in a frame;

iii) Lack of data quality (low resolution, occlusion, non-rigid warp) can modify the results of face recognition and tracking.

In this paper, we present a professional approach of cloud-based student identification approach with Local-Sensitive Hashing (LSH) [6]. The LSH method is used to present "multi batch features" after detecting and tracking each face. And to know exactly the facial tracks we use "the Multi-Task Joint Sparse Representation and Classification (MTJSRC)" [7].
In order to determine the students who could have problems in their academic career, the learner must answer a questionnaire at the time of registration to collect certain information about his/her academic background, the main characteristics of his/her personality, his/her learning skills, etc.
The analysis of the mass of information gathered from the former students of the Faculty of Charia of Fez forms the basis of a predictive system which makes it possible to determine the students likely to have problems during the formation.

2 Classification, Decision Trees J48

2.1 Classification

Classification is a procedure for grouping the information gathered in specific classes as indicated by specific criteria or likeness. It requires the determination of a component that is all around portrayed to a specific class. Additionally, the classification leads to supervised learning when models are given with known class labels whereas unsupervised learning, labels are not known. Each model in the informational index is represented by an arrangement of qualities that can be characterized or continued [8]. So, classification is the way to build the model of the entire work. The remaining model is used to predict the class label of the test model.

2.2 Decision Trees J48

The J48 classifier is an extension of C4.5. It generates a binary tree. The decision tree is most useful in problem classification. With this technique, a tree is constructed for modeling the classification process in the decision tree, the internal nodes of the tree designate a test on an attribute, the branches represent the result of the test, the leaf node contains a label and the highest node is the root node [9]. J48 avoids the lost data while building a tree and allows classification through the decision trees or rules produced by them. We can predict the value of this element by using what is known about attribute values in other folders [10].

Algorithm 1 J48

Input: D // Training data;
Output: T // Decision tree;
DTBUILD (* D);
T = ϕ;
T = Create the root node and label with the split attribute;
T = Add the arc to the root node for each expected fraction and label;
for each arc **do**
    D = Database created by the main splitting application at D;
    if the breakpoint reached for this path **then**
        T = create leaf node and label with appropriate class;
    else
        T = DTBUILD (D);
        T = add T to the arc;
    end if
end for

3 The Transfer of Information in Real Time

Information continues to grow at an astounding pace. Real-time transfer of large amounts of data between source applications and data warehouses is not an easy task and will become increasingly difficult and it is essential to design flexible and optimized methods that take into account the massive growth of structured and unstructured data.

3.1 Compact Hashing

A solution developed for the first time by Indyk and Motwani in 1998 [11], which attracted much attention and interest from researchers, it pursues a technology called compact hashing. One of his examples is the locality-sensitive-hashing. Locality-Sensitive Hashing is a way to not only maintain the similarity between elements, but also to reduce the dimensions of the large feature, since it hatches input elements so that similar elements map to the same Buckets with high probability. Index by compact code

$$P\left[H(x) = H(y)\right] = l \cdot \left[1 - \frac{\cos^{-1} x^T y}{\pi}\right]^K .$$

In Figure 1, we see some characteristic vectors; blue dots. And we can consider them as a SIFT vector (Scale-invariant feature transform) [12]. So this is found in the very dimensional feature space of which we have billions of dots in high dimensional space. It can be hundreds of dimensions or even thousands of dimensions, even if we only show them on a two-dimensional screen. So the goal is to give a query point, there could be a patch from a query image user provided. So how can we find points of correspondence

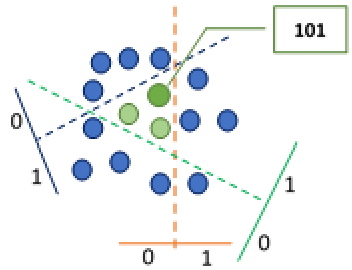

Figure 1. The compact hyperplanes hashing that allow similar elements to map into the same bucket.

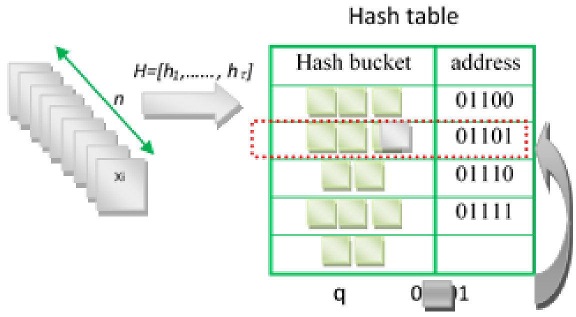

Figure 2. The character points indexed by the hash table

in these huge points of the database?
Consider h, x, and w as a hash function, a characteristic vector and a hyperplane or protective function, respectively. The operation of the locality-sensitive hashing is done as follows:
We project x in the direction of the projection function w, and the projection value will be used to decide whether it is positive or negative by taking the threshold, which is represented by a bias value b.
For multiple hyperplanes, we can repeat this process (in this example three). Thus, each hyperplane has a normal vector, and then we assign 1 or 0. We get a region of 101. This compact hash code can represent a region instead of a very high dimension of functionality When the points are very close to each other in the original function space, their hash bits would have a very high probability of being identical. This is defined as the probability of collision, which is proportional to the original similarity. So, if two points are very close to one another in the high- dimensional space originally, then after hashing, their binary bits are identical, and the probability is proportional to their similarity [13]. The Figure 2 shows the hash table implemented after having the hash code. Note that a hash table indexes all the feature points we have in the database. Each square here represents a patch or characteristic or a sample. And for n samples, each of them will be mapped to a hash code [14].

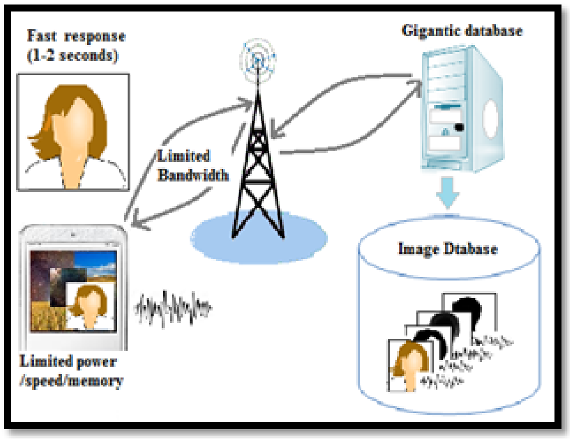

Figure 3. Facial features extraction in our system

3.2 Facial Features Extraction

The elementary component of how local feature is extracted and used to match images is also the one used to find similar images from a large database.
However, finding images from a database containing thousands of images and locations, where each image could involve hundreds of sites, hundreds of patches. This causes a great challenge as, on the side of "cloud server", we talk about millions of points or millions of "features" that must be stored and matched.
On the client side (the student), the extraction of "local feature" involves calculating the image processing. But to extract hundreds of "local features" and transmit them over the network, we will need a very quick response, this leads to many difficult problems when we design this search system such as: the power, memory and speed which are limited on mobile devices, limited bandwidth on the cellular network. So to handle all these difficult problems, there is a lot of research done in this field, not only on computer vision, image processing, feature extraction, but also on how this large dimensional feature is managed in real time.
For each face detected, a partial descriptor extracted around certain facial features is used. First a generative model is developed to locate nine key points of the face, including the left and right corners of each eye, nostrils, tip of nose and left and right corners of the mouth. Then, we extract the SIFT descriptor from each key point and concatenate them to form our final face descriptor [15].

4 The Predictive Model

It is vastly recommended to provide learners with enough time to fill in the questionnaire. That is because it is essential to apprehend the learning style appropriate to each learner. The latter can even be presented with a personal profile that comprehends their strengths and weaknesses in a certain course or field. For this reason, the following steps should be

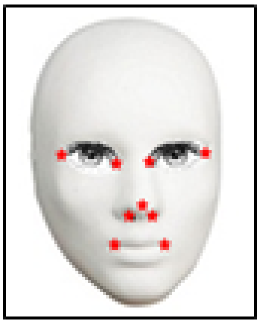

Figure 4. Examples of facial feature points.

taken:

a) By relying on the J48 method, and through the usage of data collected from earlier students we form the central part of the model.
b) Have an estimation of the strengths and weaknesses of the new students through analyzing the data collected from students who have already graduated.
c) Orienting learners towards the most appropriate profile that answers their motivation, and provide them with additional links to courses recommended by our system. These courses should be in different forms, such as videos, audios, texts, etc., depending on the student's learning style (Reflection, Reasoning, Sensory, and Progression).
d) Drawing a comparison between our findings and those predicted by the model, which would allow for further updating and improving of the latter

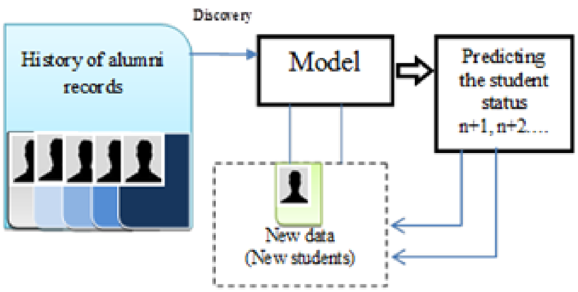

Figure 5. Predictive model of our system

5 Performance and Evaluation

In this article we searched the information of almost 3000 students of the faculty of Shariah described by 84 variables. These data are processed by several methods to achieve a model able to predict the strengths and weaknesses of new entrants. We present here the results of one of these methods of classification the J48 which gave us good results.
In this study, we will calculate the test set using the execution components, for example, the order of accuracy and run time. In addition, we discover the precision measurement and the error rate.
The execution components for these arrangement calculations are shown in Table 1 and the precision measure per class for the classifier calculations is delineated in Table 2.

Table 1. The performance factors for the decision tree J48

TP rate	Precision	F-Measure	ROC Curve	Kappa value	Execution time
0.676	0,664	0.677	0.675	0.2533	0.17

Table 2. Precision measures for decision tree J48

Correctly classified	Incorrectly classified
67.6136 %	32.3864 %

6 Conclusion

With explosive development of e-learner platform an efficient and accurate way to index and organize images according to the identities of the learner becomes heavily demanded.
Changes in the pose and illumination of the image are two main obstacles to the automatic recognition of the face. This is why we will need a new method for simultaneously handling the installation and lighting conditions.
This document opens the door to future research that may adopt other systems and methods to provide more realistic outcomes such as facial expression processing and analysis using sensors to determine the emotional states of e-learners. Or even detect the psychological state of an e-learner through his behavior during the course. We can also improve our system by adding more devices that will help us to orient learners in their academic careers and even in the choice of the subject of their research projects.

References

[1] Xiaohu Ge, Xi Huang, Yuming Wang, Min Chen, Qiang Li, Tao Han, and Cheng-Xiang Wang. Energy-efficiency optimization for mimo-ofdm mobile multimedia communication systems with qos constraints. *IEEE Transactions on Vehicular Technology*, 63(5):2127–2138, 2014.
[2] Matthew Turk and Alex Pentland. Eigenfaces for recognition. *Journal of cognitive neuroscience*, 3 (1):71–86, 1991.
[3] Kamran Etemad and Rama Chellappa. Discriminant analysis for recognition of human face images. *Josa a*, 14(8):1724–1733, 1997.
[4] Jian Yang, David Zhang, Alejandro F Frangi, and Jing-yu Yang. Two-dimensional pca: a new approach to appearance-based face representation

and recognition. *IEEE transactions on pattern analysis and machine intelligence*, 26(1):131–137, 2004.

[5] Josef Sivic, Mark Everingham, and Andrew Zisserman. who are you?-learning person specific classifiers from video. In *2009 IEEE Conference on Computer Vision and Pattern Recognition*, pages 1145–1152. IEEE, 2009.

[6] Jianqiu Ji, Shuicheng Yan, Jianmin Li, Guangyu Gao, Qi Tian, and Bo Zhang. Batch-orthogonal locality-sensitive hashing for angular similarity. *IEEE transactions on pattern analysis and machine intelligence*, 36(10):1963–1974, 2014.

[7] Xiao-Tong Yuan, Xiaobai Liu, and Shuicheng Yan. Visual classification with multitask joint sparse representation. *IEEE Transactions on Image Processing*, 21(10):4349–4360, 2012.

[8] B Kavitha, S Karthikeyan, and B Chitra. Efficient intrusion detection with reduced dimension using data mining classification methods and their performance comparison. In *International Conference on Business Administration and Information Processing*, pages 96–101. Springer, 2010.

[9] H Dunham Margaret. Data mining introductory and advanced topics. *Pearsons Education Inc*, 2003.

[10] William E Spangler, Jerrold H May, and Luis G Vargas. Choosing data-mining methods for multiple classification: representational and performance measurement implications for decision support. *Journal of Management Information Systems*, 16(1):37–62, 1999.

[11] Piotr Indyk and Rajeev Motwani. Approximate nearest neighbors: towards removing the curse of dimensionality. In *Proceedings of the thirtieth annual ACM symposium on Theory of computing*, pages 604–613, 1998.

[12] David G Lowe. Object recognition from local scale-invariant features. In *Proceedings of the seventh IEEE international conference on computer vision*, volume 2, pages 1150–1157. Ieee, 1999.

[13] Qin Lv, William Josephson, Zhe Wang, Moses Charikar, and Kai Li. Multi-probe lsh: efficient indexing for high-dimensional similarity search. In *33rd International Conference on Very Large Data Bases, VLDB 2007*, pages 950–961. Association for Computing Machinery, Inc, 2007.

[14] Aristides Gionis, Piotr Indyk, Rajeev Motwani, et al. Similarity search in high dimensions via hashing. In *Vldb*, volume 99, pages 518–529, 1999.

[15] Wenyi Zhao, Rama Chellappa, P Jonathon Phillips, and Azriel Rosenfeld. Face recognition: A literature survey. *ACM computing surveys (CSUR)*, 35(4):399–458, 2003.

Hachem H. Alaoui is a professor at the Multidisciplinary faculty, Ibn Zohr University, Smara of Morrocco, is titular of a Ph.D. in artificial intelligence for the development of E-Learning, author of several indexed publications.

Elkaber Hachem is a professor at the Faculty of Sciences, Moulay Ismail University, Meknes of Morrocco, is titular of a Ph.D. in soft matter physics & colloides and expert in E-Learning. He is head of the team of recherche : "Innovative Research & Applied Physics", author of several indexed publications, member of editorial team and member of peer reviewers of more than the 10 international journals and member of the organization/scientific committees of a series of National and international conferences. He is conducts research in three research domains: soft matter physics (stability of micro-emulsions, polymer-clay hybrids), renewable energy (photovoltaic/thermal "PV/T" hybrid solar system) and development of an intelligent tutor for the E-Learning.

Cherif Ziti is a professor at the faculty of Sciences, Moulay Ismail University, Meknes of Morrocco, is titular of a Ph.D. in numerical analysis and partial differential equation Ph.D. in Saint tienne France. He is head of the team of research : "EDP & Scientific Calculation, author of several indexed publications. He does research in the following dommains : numerical analysis, partial differential equation, image processing, modeling, scientific computing programming and algorithm.

Mohammed Karim is a professor of computer science and electronics at the faculty of sciences of Fez-Morrocco, is titular of a Ph.D. (1992) in electronics and industrial data processing of the ULP of Strasbourg France. He is a head of the LISTA research Laboratory. He was a head of the ISAI Master, author of several indexed publications, chairman of the organization/scientific committees of a series of workshops and conferences. He is currently working on different projects: nano satellite, E-learning, renewable energy, computer vision, biomedical engineering, and etc.