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Feature Evolution using Factorization Methods in Multimodal Authentication – Smart Security Devices

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Abstract: Most of the industries and business organizations use various kinds of biometric patterns such as face, finger, palm, vein, skin surface, footprint and some structural parts of the human body and also to consider some video patterns of the stakeholder/customeras secure data for the customers /stakeholders in terms of authentication / verification / authorization/ recognition of traits and also use secure agents for the personal data as well as social/ business/ web/ banking transactions. Also, the government sector use the biometric patterns of stakeholders to claim the government policies, facilities and issue the authorized cards like aadhaar, driving license, passport, pancard etc.., for their needs. The stake holders would provide different patterns of his/ her poster as face, fingerprint, palm, vein, footprint, and/ or other structural patterns of the human body in terms of 2D and 3D patterns. In order to compute such patterns the extraction of features/ recognition of patterns is complex and NP-hard due to the representation of captured patterns with noise or acquisition of sensed data or noisy of sensing devices. To overcome such complexities the vector logic (cognitive logic) models for minimizing the noise and computations of best features for recognition of such patterns.

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I. Introduction

In the process of authentication/ recognition biometric patterns, data will be represented as images after data acquisition then mapped to monadic/ dyadic data matrix representation for the computational process and also for decision strategy. The computational process of authentication can be done either in uni-model or multi-model; also either fusion or non-fusion approaches; also either pixel level/patch level/ feature level/template based/ decision level process/the combination of these approaches at different stages. For such process, the data as eigen-value or eigen-vector approach or the block matrix structure approach or any other decomposition/factorization techniques with the helpcognitive logic models.

Feature extraction and feature selection is one important pre-processing task that takes place a major role in the domain of machine learning and pattern recognition applications. Feature evolution is an important key issue for constructing feature selection algorithm. Feature selection plays an essential role for dimensionality reduction. Since redundant information usually covers a numerous features in the real world applications that may confuse learning techniques that cause distinguishes slowdown in the learning process and to increase the risk of classifiers to over fit training data, removing irrelevant features is necessary in the classification modeling. A lot of candidate features are usually provided to learning strategy for producing a complete characterization of the classification. The majority of the candidate features are irrelevant or

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redundant to the learning task that deteriorate the performance of the learning task and lead to the problem of over fitting.

In this aspect, various kinds of traditional factorization methods such as SVD and its variants like Sparse SVD, Truncated SVD, HOSVD, Lagrange SVD, PCA, LU, QR/QZ methods. In addition to these methods, different strategies in matrix algebra would be considered such as Non-Negative Matrix Factorization and its Variants including Probability based approaches such as Bayesian based Matrix Factorizations approaches for feature extraction and selection of biometric patterns of the stakeholder at various levels of authentication process.

At the verification level, various distance metrics can be applied to make the decision for recognition or verification of such patterns based on stakeholder's data and database. In general, the bio-metric agents used point based distance metrics such as Euclidian distance, City block distance, weighted distance, min-max distance and so on. When considering cognitive logic models for the computation of these patterns, the decision strategy will not workout because the patterns data is in the form of vectors/matrices. To solve such a problem, at the decision level for effective outcome of the recognition, a heuristic based distance metrics often called pair-wise distance metrics like Hausdroff distance and its variants, normalized correlation, trotter distance, personal distance, and some statistical vector distance metrics may be considered. The main aim of these metrics is to produce quality recognition of the biometric patterns that improves efficiency and the accuracy of the models.

The aim of this proposal is to design and development of intuitive models of cognitive logic that utilize matrix calculus which facilitates to recognize/ verify the patterns of the traits effectively and efficiently with accurate outcome.

II. Objective

The main objective of the task is to classify the patterns of bio-metric data and form multimodal authentication/verification using cognitive logic for the recognition of behavioral, physical, psychological patterns of human beings.

In cognitive logic, various computational techniques can be used for the combination of two or more bio-metric pattern features. These features will be extracted using feature extraction techniques such as PCA, LDA, ICA, SVD and its variants. In the computational process, advanced matrix algebra(Tensor algebra) can be used. At the decision/verification level intuitive distance metrics (city block distance, personal distance and so on) can be used.

The main intention of this proposal is to speed up the process of verification of patterns, to reduce the noise and to increase the computational complexity, but this approach needs more space.

The main objective of this proposal is to speed of the whole processing that needs identification of biometric patterns, authentication of multimodal patterns, recognition of human patterns based on their emotions, or traits of the human structure. The objective would further comprise of faster recognition and improve the image de-noising and also aims at resulting in faster computation in terms of time and space.

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III. Methodology

The analysis of this task is mainly done in various ways of computation, viz., non-fusion based multimodal authentication/ recognition of biometric patterns, fusion based multimodal authentication/ recognition of patterns, segment based approach, template based. In the computational process the task can be done in 2 to 3 levels as described.

In Level 1: The features of sensed patterns or the patterns which are considered from the database can be extracted and specified as key components based on the selection of best features.

In Level 2: The features which are selected from level 1 can be combined using cognitive dynamical models with the use of Tensor Logic as Cognitive Logic.

In Level 3: The decision process can be done using various kinds of point wise distance metrics and/or pairwise distance metrics. At the final stage of these levels, the best decision strategy will be chosen from the distance metrics for the verification process.The prime aspect of this task is to apply security on different biometric patterns of the specified stakeholders, detect fraud data/ apply analytics on such data for future analysis using Cognitive dynamical models with the support of Tensor Algebra.

IV. Conclusion:

The paper presents a study model proposing through different levels of feature extraction. This implementation requires the high effectiveness in data gathering and cleaning process. The distance metrics and evaluation should be carried very intuitively else the model becomes inefficient. Task is to design and develop the Smart Valets for keeping the cards such as aadhar card, pan card, ration card, Driving License, Passport and so on including the biometric traits using the above said methodology.