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Investigation Of Face Detection Methods

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Abstract:*Facedetectionandmonitoring has been a verycommonresearchtopic in recentyears. Inordertoclassify a face, the "face" part of theimagemustfirst be identified. Theimagesareusuallydrawnfromthefront of thepeople. Themostimportant problem here is thatthepart of thefacearea in theimage is extractedcorrectly. Becausethepositionand size of thefaceregion can varyforeachimage, it is not possibletousethesametype of templatefortheextraction of facepartsfromimages. Because of this, faceparts, variousfacedetectiontechniques, ormanualworkoutcomesareremoved. Since it is not a definiteanddefinitemethod, it is not possibletoremove 100 percent of thefaceinformationevenif it is donebyhand. Whenwetakeouttwofaceimages in differentsizes, theprobabilitythatthesizes of theextractedfacesaredifferent is % 99.9, andevenifthe size is equalized, eachfaceimagematrixvalues will be mathematicallydifferent in size.*

Keywords:*Facedetectionmethods*

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I INTRODUCTION

Facerecognition is a classificationprocess on a facewithfeaturesremoved. Itextraction of properties; fromdevelopingrulesbased on priorityinformation, toprovidingmethodsforfindinginvariantfacialqualities. Inordertoextractthefacialfeatures, it is firstnecessarytofindtheplace of thefacecorrectly.Fourdifferentapproacheshavebeenidentified as fundamentaltothesolution of thefacefindingproblem :

- Knowledge-basedmethods : Thesemethodsarebased oncorrelationsbetweenfacialfeaturestherulesaredefined.
- Templatematchingmethods: Templates of faceordistinctfacialfeaturesareusedforfacedetection. Therelationshipbetweenthesetemplatesandthegivenimage is usedtodeduce.
- Attribute-basedmethods : Facialmodelsareobtainedthroughfacialfeatures. Theaim here is to achievegreatersuccesswith a highdegree of change in education.
- Image basedmethods : Againstexposure, covering, expression, imageconditionsandrotationproblems; aremethodsaimingtohavestructuralfeatures of theface.

1.1 Knowledge-basedmethods

Thismethod has beendevelopedbased on predefinedrulesderivedfromfacialinformation. Forexample, an image in an imageoftenappears as symmetricallypositionedeyes, a noseand a mouth. Relation betweentherelativedistanceandpositionbetweenfeatures can be expressed. Indetectingthefacialimage, thecandidatepattern is determinedaccordingtothesecodedrules.

YangandHuang "in thisstudyused a hierarchicalknowledge-basedmethodforfacedetection. An expandedversion of thisworkwasdonebyKotropoulosandPitas, usingthe idea of multipleresolution in frontalviews [1,2].

Figure 1.1 : Knowledgebasedfacedetectionmethodsampleimage

1.2Attribute-basedmethods

Thehumaneye can easilyperceivefaces in differentposesanddifferentlightingconditions.Inadditiontoallthesedifferentconditions, theremust be constantqualities. Somemethodsfirstperceiveeyebrow, eye, nose, mouthandhairlinewithedgedetectorsandthenconfirmbyfindingfaces. Ten coloring can also be used as a feature. Depending on theextractedattributes, a statistical model is createdto definetherelationshipbetweenthemandtoprovetheexistence of theface. A potentialdrawback in attribute-basedalgorithms is thattheirimageattributesaredegradedduetolighting, noise, andclosure. Theboundaries of theattributesbecomeobscuredbythestrongedges of theshadows. Thiscausesthealgorithmstobecomeinsufficient.

Working on attribute-basedsystems, Sirohey[3]usededgemaps. Leung[4]usedthenostril, eyeand lip/noserelationshiptodescribethefaceusing a probablemethodforfacedetection.Burl[5]andLeung[6]havemadechangestotheuse of thestatisticaltheory of shapes.Manymethodshavebeenproposedfortheuse of skin color as an attribute.

The RGB colorspace is usedtodetect skin areas [7]. Then, furtherprocessing is donetoprovetheexistence of theface. Insomestudies, thehistogram of thevalues in theadjusted RGB colorspace is used[8]. Inthestudy of SobottkaandPitas [9], HSV colorspaceandfacialfeatureswereusedfortheextractionandlocation of theface. IntheHSV space, theseparation of colors is donetofindareassimilartothe skin, andthentheexistence of theseareas is provedbythe presence of thefacialfeatures inside.

AnothercolorspacestudywasdonebyChiaandNgan [10]. YCrCbcolorspace is usedtodeterminethelocation of face-relatedareas of colorimages. Symmetrybasedcostfunctiondetection is used in asystemthat is recommendedtodetectfacesfirst. Here, YES colorspace is usedtogetherwiththeproposedsystemtoextractfacialfeatures [11].

1.3 Templatematchingmethods

Thetemplatematchingmethod, a standardtemplaterepresentedby a frontfaceor a predefinedfunction. In a giveninputimage, thecorrelationvaluesarecalculatedindependentlyfromeachotherfor a contourline, eye, noseandmouthwith a standardtemplate. Based on theannotationvalues, it is decidedwhetheror not it is a face. Inadditiontotheease of implementation of thisapproach, there is also a reduction in detectionperformanceduetochanges in scale, exposure, andshapeforfacedetection. Multi-resolution, multi-scale, sub-templates, andtheuse of templatesthat can change format areproposedtoachieveunchangedscaleandshape. Tsukamato [12]proposedthateachinstance of theview is dividedintoblocksandfeatures (brightnessandedge) andthattheyareestimatedforeachblock.

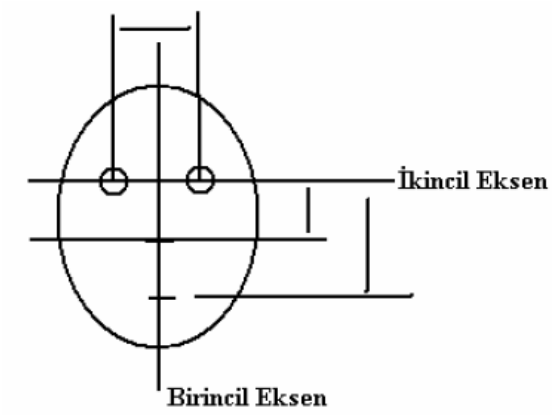

Figure 1.2 : Facetemplatesample

1.4 Image basedmethods

In most of these methods, human faces are searched by applying a low size window on the reduced image frames in certain quantities. In order to find faces, parts taken from the image are compared to models trained or hand made[13].

These approaches are very sensitive to the displacement and posing of the face. A view-based face detection process includes the following main steps[14]:

1. Images to be detected face to face with a preliminary process to be brought to match the way to find.
2. The uniform formatting of test and training images.
3. Algorithm training with negative and sometimes positive input information.
4. Implementation of a search trace for detection of the faces.

A preliminary process in the first images of the receiver basically aims to bring the characteristics of the input images such as color density, edge, background pattern, size, shape, color diversity and contrast distribution into a single standard. This step is particularly important and critical for face detection applications where different face orientations, different brightness conditions and mixed backgrounds are intended to be operated.

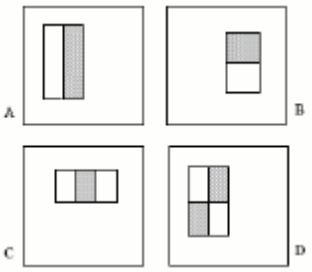

Figure 1.3 : Image-based face detection method feature rectangles

Figure 1.4 : Example of application of property rectangles on an image

Appearance based face detection methods often use well-known classification algorithms developed within the context of shape recognition, machine learning and data mining.

Known classification algorithms are:

1.Principal Component Analysis(PCA)
2.Linear Discriminant Analysis(LDA)
3.Factor analysis(FA)
4.Hidden Markov Model(HMM)
5.Adaboost
6.Statistical Distribution Based Methods
7.Support Vector Machine(SVM)
8.Artificial neural networks(ANN)
9.Inductive Learning
10.Naive Bayes Classifier(NBC)

These grouped algorithms are as follows:

1.4.1 Linear Subspace Methods

Gray-level face images form a subspace within all multi-dimensional image areas. In fact, it is tried to represent this subspace with all classifiers. FA, LDA and PCA are the methods used to represent the subspace formed by human duplicates.

1.4.2 Statistical Approaches

NBC and SVM classifier example. In particular, SVM has been successfully used in the solution of two class problems and has been used in more than one face detection algorithm.

1.4.3 Artificial Neural Networks

ANN is a logical software developed to imitate the working mechanism of the human brain and to perform basic functions such as brain learning, recall generalization, and deriving new information. ANN are synthetic constructs that mimic biological neural networks. Since the ANN runs slowly, it has been used in many applications, especially with no time limitations, and successful results have been achieved [15].

1.4.4 Adaboost

Many successful faces were detected using AdaBoost algorithm. This algorithm has been successful in two class problems such as classification, gender and face detection. Schapire and Singer have extended AdaBoost to multiple class and multi-label versions.

In Figure 1.5, a two-part example classified by AdaBoost is shown.

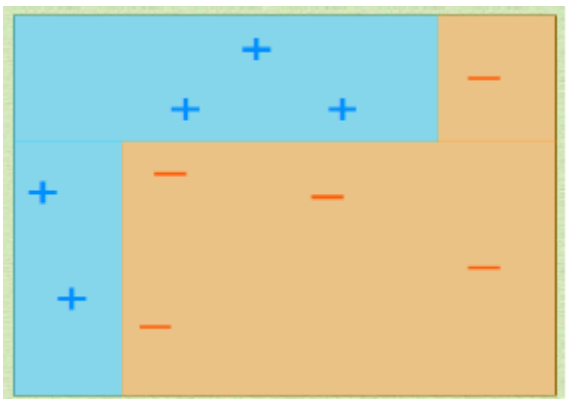

Figure 1.5 :Adaboost classification example

The goal of the algorithm is to create a weak classifier based on a D distribution computed over training samples. D distribution is the set of coefficients that the algorithm gives to each example in the training set.

The AdaBoost algorithm starts with an equal distribution of D for each training instance. Each step has the best weak classifier depending on the classification performance and the weights are updated to obtain a probability distribution function. In the next step, these operations are repeated and a powerful classifier is created by combining the strongest weak classifier as a result of a certain number of iterations. Figure 1.6 shows the AdaBoost classifier.

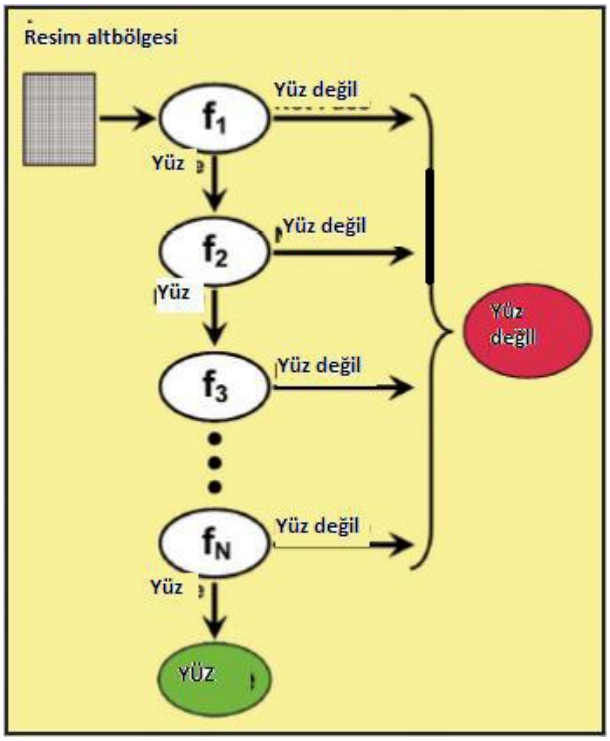

Figure 1.6:The AdaBoost classifier.

In the face detection process, it is necessary to be successful from all classifiers for the face of an area.

II CONCLUSION

In this study, various approaches have been compared with different approaches to recognize human face. Each of these approaches has significant advantages. But so far no excellent method has been developed.

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