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YÜZ TANIMA: ÖZ YÜZLER, YAPAY SİNİR AĞLARI, GABOR DALGACIK DÖNÜŞÜMÜ YÖNTEMLERİ

Halit Ergezer

YÜKSEK LİSANS TEZİ BİLGİSAYAR MÜHENDİSLİĞİ BÖLÜMÜ
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Son yıllarda yüz tanıma alanında önemli gelişmeler kaydedilmiştir. Yüz tanıma, kontrollü alanlara girişte, başta havaalanlarında olmak üzere güvenlik kontrolü yapılan yerlerde, bankacılıkta kimlik onaylamada, insanlarla makineler arası etkileşiminde ve aranan kişilerin tanınmasında kullanılan özel bir örüntü tanıma konusudur. Tekniklerin gelişmesiyle günümüzde bilgisayarlar yüz tanıma işlemini insanlardan daha iyi yapar duruma gelmişlerdir.

Bu teknikler gerekli koşulların sağlandığı ortamlarda oldukça iyi sonuçlar vermelerine karşın, ortam şartlarındaki küçük değişimlerde yüz tanıma problemi büyük ölçüde çözümsüz kalmaktadır. Bu çalışmamızda gerçek zamanlı yüz tanıma sistemlerinde kullanılabilirliğini test etmek amacı ile bu alanda en yaygın algoritmalar öz yüzler, sinir ağları, Gabor dalgacık yöntemlerini kullandık. Bu algoritmalar ORL veritabanına ve ARDB' ye uygulandı. Bu veritabanları farklı özelliklere sahiptir. ORL veritabanında 40 kişiye ait resimler yer almaktadır. Bu veritabanı her kişi için 10 farklı resim içermektedir ve bu resimler dönüş, yönlendirme ve parlaklık açısından farklıdırlar. ARDB'de ise her kişi için 26 farklı resim vardır ve bu resimler birbirlerinden yüz ifadeleri, parlaklık ve yüzün belli kısmının kapalı olması (güneş gözlüğü atkı v.b) gibi faktörlerle ayrılmaktadırlar.

Öz yüzler yöntemi yüz uzayının temel bileşenlerini ve yüz vektörlerinin temel bileşenler üzerine izdüşümünü kullanır. Bu yöntem boyut indirgeme yöntemidir ve yüz uzayının boyutunu azalttığı için tanıma ve öğrenme işlemleri hızlıdır. Resimler dönüş ve yönlendirme bakımından normalleştirildiğinde bu yöntemin doğruluk performansı kabul edilebilir bir düzeydedir. En iyi performans %92 olarak kaydedilmiştir.

Yapay sinir ağları metodunda, büyük resim bilgisi yüzünden giriş vektörlerinin boyutlarını azaltmak için sıkıştırma metodu (DCT) kullanıldı. Sıkıştırma metodundan elde edilen katsayılar zig-zag tarama algoritması ile tek boyuta indirgenerek ağa giriş olarak verildi. Bu ağların çalışma zamanı çok zaman gerektirdiğinden bilinmeyen bir yüz resmi girdi olarak verildiğinde ağları güncelleştirmek mümkün değildir. Bu metotla elde edilen en iyi sonuç %95 olarak kaydedildi.

Gabor dalgacık dönüşümü, insan görme sistemindeki duyumsal bölgelerin davranışını modellediğinden öznitelik vektörlerini oluşturmada kullanılmıştır. Gabor dalgacık dönüşümü yöntemi diğer iki yöntemden farklıdır. Bu metotta tanıma için öznitelik vektörleri çıkarılır ve karşılaştırılır. Dolayısıyla her bir kişi için tek bir yüz yeterlidir. Deneysel sonuçlar bu metodun kullanılan diğer iki metottan daha iyi sonuç verdiğini göstermiştir. En iyi performans %98 olarak kaydedilmiştir.

Anahtar Sözcükler: Yüz Tanıma, Öz yüzler, Yapay Sinir Ağları, Gabor Dalgacık Dönüşümü.

ABSTRACT

FACE RECOGNITION: EIGENFACES, NEURAL NETWORKS, GABOR WAVELET APPROACHES

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In recent years considerable progress has been made in the area of face recognition. Face recognition is a specialized pattern recognition task with several applications such as security: access to restricted areas, banking: identity verification, and recognition of wanted peoples at airports. Through the development of techniques computers can now outperform humans in many face recognition tasks.

Whilst these methods perform extremely well under constrained conditions, the problem of face recognition under gross variations remains largely unsolved. The aim of this study is finding the appropriate algorithm for the real time face recognition system. For this reason, we have implemented the most popular approaches; eigenfaces, neural networks, and Gabor wavelet approach. These algorithms have been applied to the ORL and ARDB. These databases have different characteristics, in ORL database there are 10 images for each individual, and images are different from each other in terms of orientation, rotation, illumination, in ARDB there are 26 images for each individual and images consist of frontal view faces with different facial expressions, illumination conditions, and occlusions.

The eigenfaces approach uses the principal components of the face space and the projections of face vector for recognition. This method is the method of dimensionality reduction, so it is fast. Its accuracy is acceptable when the images have been normalized in terms of rotation and orientation. The best result obtained from this approach is recorded as 92%.

In neural networks approach, because of the huge image data we have used the compression method (DCT) to reduce the dimensionality of input vectors. The coefficients obtained from the compression method were converted to column vectors and then were fed into the network as input. Since the training step of these networks require so much time it is not possible to update the networks when an unknown face image given as an input. The best result obtained from this approach is recorded as 95%.

Gabor wavelet transform is used for facial feature vector construction due to its powerful representation of the behavior of receptive fields in human visual system (HVS). Gabor wavelet transform approach is different from the other two approaches, in this method there is no training step, only feature extraction and comparison of these features are used for recognition. So, a single frontal face for each individual is enough as a reference. The experimental results with standard image libraries show that the proposed method performs better compared to the neural network and eigenface-based methods. The best result obtained from this approach is recorded as 98%.

Keywords: Face Recognition, Eigenfaces, Artificial Neural Network, Gabor Wavelet Transform.

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