

Recognition of Retinal Image Using Radial Basis Function For Authentication

Priyanka Mishra*, Suyash Agrawal**

** (Department of Computer Science & Engineering Rungta college of Engineering & Technology, Kurud Bhilai, CSVT University, Chhattisgarh)

** (Department of Computer Science & Engineering, Rungta college of Engineering & Technology, Kurud Bhilai, CSVT University, Chhattisgarh)

ABSTRACT

Images of the eye ground or retina not only provide an insight to important parts of the visual system but also reflect the general state of health of the entire human body. Automated retina image analysis is becoming an important screening tool for early detection of certain risks and diseases like diabetic retinopathy, hypertensive retinopathy, age related macular degeneration, glaucoma etc. This can in turn be used to reduce human errors or to provide services to remote areas. Exudates are one of the primary signs of diabetic retinopathy, which is a main cause of blindness and can be prevented with an early screening process.

Keywords - Retinal Information, image processing, Neural Networks in Supervised learning & Radial basis function (RBF)

I. INTRODUCTION

The vertebrate retina is a light-sensitive tissue lining the inner surface of the eye. The optics of the eye create an image of the visual world on the retina, which serves much the same function as the film in a camera. Light striking the retina initiates a cascade of chemical and electrical events that ultimately trigger nerve impulses. These are sent to various visual centers of the brain through the fibers of the optic nerve. The Retina is a membrane in the eye, responsible for controlling the amount of light reaching the retina. The retina consists of pigmented fibro vascular tissue known as a stoma. It is the most forward portion of the eye and the only one seen on superficial inspection, which contracts the pupil, and a set of dilator muscles (dilator papillae) which open it [1]. The back surface is covered by a heavily pigmented epithelial layer that is two-cells-thick (the iris pigment epithelium), but the front surface has no epithelium. The high pigment content block light from passing through the iris and restricts it to the pupil. The outer edge of the iris, known as the root, is attached to the sclera and the anterior ciliary body. The retina and ciliary body together are known as the anterior uvea. Just in front of the root of the retina is the region through which the aqueous humor constantly drains out of the eye, with the result that diseases of the iris often have important effects on intraocular pressure, and iris makes the pupil larger or smaller. The plural form of retina, in this context, is retinas.

II. HEADINGS

Retinal image are very important biometric information after thumb impression. Due to uniqueness in nature it can further be used for all kinds of authentication and security application from home to office. Faster algorithms is

required to recognize the retinal information and also it is require to develop a retinal image recognition system which is able to run for simple webcams.

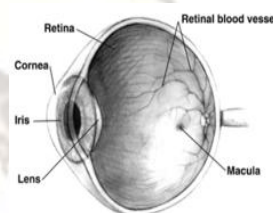


Fig:2 Human Eye

Retinal recognition is a method of biometric authentication that uses pattern-recognition Techniques based on high resolution images of the irises of an individual's eyes. Not to be confused with Subtle another, less prevalent, retina scanning, and iris recognition uses camera [13]. Converted into digital templates, these images provide mathematical representations of the iris that yield unambiguous positive identification of an individual. Iris recognition efficacy is rarely impeded by glasses or contact lenses. Iris technology has the smallest outlier those who cannot (use/enroll) group of all biometric technologies.

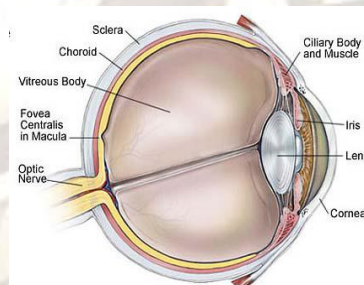


Fig:2 Sagittal section of the human eye

Broadcast-Data are periodically broadcast on a wireless channel open to the public. Instead of submitting a request to the server, a mobile user tunes into the broadcast channel and filters out the data based on the query and its current location. The human retina is a thin tissue composed of neural cells that is located in the posterior portion of the eye. Because of the complex structure of the capillaries that supply the retina with blood, each person's retina is unique. The network of blood vessels in the retina is so complex that even identical twins do not share a similar pattern.

III. INDENTATIONS AND EQUATIONS

A focus of this research is to improve performance of the development of automated system can be effectively used as a filter of normal images, thereby reducing the burden on ophthalmologist, in addition to improvement of efficiency of diabetic screening program and reduction of cost. Human eye can be examined noninvasively for various clinical disorders using digital retinal image. Hence quantitative analysis of different features from retinal images has usually been studied. Automated image analysis has the potential to assist in the early detection of diseases but This technique ensure uniqueness of a person identity. Due to uniqueness in nature it can further be used for all kinds of authentication and security application from home to office. RBF method is successfully used to Recognition of Retinal Image.

EQUATIONS

Commonly used types of radial basis functions include $r = \|\mathbf{x} - \mathbf{x}_i\|$

1 Gaussian:

$$\phi(r) = e^{-(\varepsilon r)^2}$$

2 Multi quadric:

$$\phi(r) = \sqrt{1 + (\varepsilon r)^2}$$

3 Inverse Quadratic:

$$\phi(r) = \frac{1}{1 + (\varepsilon r)^2}$$

4 Inverse Multi quadric:

$$\phi(r) = \frac{1}{\sqrt{1 + (\varepsilon r)^2}}$$

5 Poly harmonic spline:

$$\phi(r) = r^k, \quad k = 1, 3, 5, \dots$$

$$\phi(r) = r^k \ln(r), \quad k = 2, 4, 6, \dots$$

6. Thin plate spline:

$$\phi(r) = r^2 \ln(r)$$

Radial basis functions are typically used to build up function approximations of the form

$$y(\mathbf{x}) = \sum_{i=1}^N w_i \phi(\|\mathbf{x} - \mathbf{x}_i\|),$$

where the approximating function $y(\mathbf{x})$ is represented as a sum of N radial basis functions, each associated with a different center \mathbf{x}_i , and weighted by an appropriate coefficient w_i . The weights w_i can be estimated using the matrix methods of linear least squares, because the approximating function is linear in the weights.

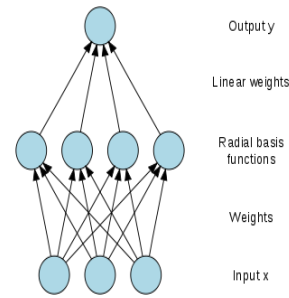


Fig: 3 Network architecture

Architecture of a radial basis function network. An input vector \mathbf{x} is used as input to all radial basis functions, each with different parameters. The output of the network is a linear combination of the outputs from radial basis functions. Radial basis function (RBF) networks typically have three layers: an input layer, a hidden layer with a non-linear RBF activation function and a linear output layer.

IV. FIGURES AND TABLES

Retinal scanners are typically used for authentication and identification purposes. Retinal scanning has been utilized by several government agencies including the FBI, CIA, and NASA. However, in recent years, retinal scanning has become more commercially popular. Retinal scanning has been used in prisons, for ATM identity verification and the prevention of welfare fraud.



Fig: 4 Retinal Scan Model

IV.I IMAGE PROCESSING

Image-processing operations transform the grey values of the pixels. There are three basic mechanisms by which this is done. In its most simple form, the pixels grey values are changed without any processing of surrounding or 'neighborhood' pixel values. Neighborhood processing incorporates the values of pixels in a small neighborhood around each pixel in question. Finally, transforms are more complex and involve manipulation of the entire image so that the pixels vales are represented in a different but equivalent form. This may allow for more efficient and powerful processing before the image is reverted to its original mode of representation. The aims of processing of an image normally falls into one of the three broad categories: enhancement (e.g., improved contrast), restoration (de blurring of an image).

IV. II NEURAL NETWORK

Neural networks are composed of simple elements operating in parallel. These elements are inspired by biological nervous systems. As in nature, the network function is determined largely by the connections between elements.

We can train a neural network to perform a particular function by adjusting the values of the connections (weights) between elements. Commonly neural networks are adjusted, or trained, so that a particular input leads to a specific target output. Such a situation is shown below. There, the network is adjusted, based on a comparison of the output and the target, until the network output matches the target. Typically many such input/target pairs are used, in this supervised learning, to train a network.

There are three types of learning as follows:

1. Supervised Learning
2. Un Supervised Learning
3. Reinforcement Learning

Supervised Learning :- Supervised Learning is the process of providing the network with a series of sample inputs and comparing the output with the expected responses. The training continues until the network is able to provide the expected response. In a neural net, for a sequence of learning input vectors there may exist target output vectors. The weights may then be adjusted according to a learning algorithm. This process is called Supervised Learning.

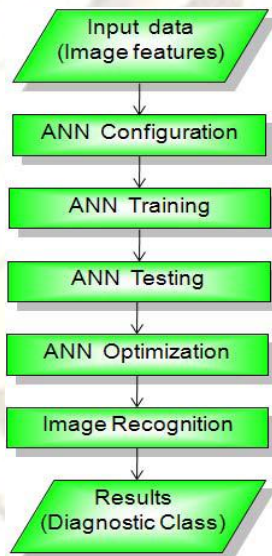


Fig: 4.2 Image recognition process using ANN

IV.III RADIAL BASIS FUNCTION

A radial basis function (RBF) is a real-valued function whose value depends only on the distance from the origin, so that or alternatively on the distance from some other point c , called a *center*. Any function ϕ that satisfies the property is a radial function. The norm is usually Euclidean distance, although other distance functions are also possible. For example by using Lukasz k- Karmowski metric, it is possible for some radial functions to avoid problems with ill conditioning of the matrix solved to determine coefficients w_i (see below), since the is always greater than zero. Sums of radial basis functions are typically used to approximate given functions. This approximation process can also be interpreted as a simple kind of neural network. Radial functions are simply a class of functions. In principle, they could be employed in any sort of model (linear or nonlinear) and any sort of network (single_ layer or multi_

layer) radial basis function networks (RBF networks) have traditionally been associated with radial functions in a single layer network. [15]

An RBF network is nonlinear if the basis functions can move or change size or if there is more than one hidden layer. Here we focus on single layer networks with functions which are fixed in position and size. We do use nonlinear optimization but only for the regularization parameter(s) in ridge regression section and the optimal subset of basis functions in forward selection section. We also avoid the kind of expensive nonlinear gradient descent algorithms (such as the conjugate gradient and variable metric methods) that are employed in explicitly nonlinear networks. Keeping one foot firmly planted in the world of linear algebra makes analysis easier and computations quicker. [15]

The RBF networks constructed with the proposed learning algorithm and those constructed with a conventional cluster-based learning algorithm. The most interesting observation learned is that, with respect to data classification, the distributions of training samples near the boundaries between different classes of objects carry more crucial information than the distributions of samples in the inner parts of the clusters.

NETWORK TOPOLOGY

Radial Basis Function are embedded into a two layer feed-forward neural network. Such as network is characterized by a set of inputs and a set of output. In between the inputs and outputs there is a layer of processing units called hidden units. Each of them implement a radial basis function. The way in which the network is used for data modelling is different when approximating time-series and in pattern classification.

INTEGRATED TOPOLOGY(RBFs)

Let the notation represent a global infinitely differentiable RBF containing a shape parameter c that has been integrated ($n > 0$) or differentiated ($n < 0$) n times with respect to r . We refer to these RBFs as integrated RBFs (IRBFs), as it is the case $n > 0$ that we are interested in for use in approximations. IRBFs are easily found using a computer algebra system.

RBF APPROXIMATION

One way to approximate noisy data is to specify a fitting tolerance as described in the RBF FAQ. This inexact fitting process is exploited by the greedy fitter to achieve significant data reduction. Although there is an inherent tendency with the greedy algorithm to favour absorption of lower frequencies before higher ones, resulting in a smoother surface, it does not enforce any optimality on the approximating RBF. Fast RBF™ now offers two approximation strategies for fitting to noisy data which optimise different criteria. These are

- Smoothest restricted range (error-bar) fitting
- Spline smoothing

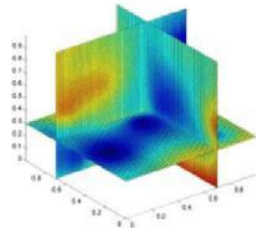


Fig:5.4.1 RBF approximation

V. CONCLUSION

In this project work, I have presented a Retinal image using different Functions and methods For research papers This technique ensure uniqueness of a person identity. Due to uniqueness in nature it can further be used for all kinds of authentication and security application from home to office. Proposed algorithm tends to recognize retinal images faster than the persons technique available Complexity. Purposed work will optimize the time and space of the system for detecting and Recognizing the retinal images.

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