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Detection of Urdu Sign Language using Harr Algorithms

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Abstract— ***This research focuses on detecting process of Urdu sign language. Sign language is a language used in culture of deaf people. There are two approaches used in the development of this work, the first one is text to sign conversion and the other is sign to text conversion. In the first strategy, 'text to sign' involves a text input from a text box and the output will be displayed in image form on the screen. In the second strategy, 'sign to text' involves a sign as an input through webcam and its output will be in text form which will actually stand for the actual sign. The purpose of developing this project is to reduce the communication gap between the normal and physically challenged persons such as deaf people as they are also part our community.***

Index Terms— ***Sign Language, Urdu Sign Language, Sign Detection, Haar Algorithms***

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I. INTRODUCTION

The thought which led towards the development of this research is to reduce the communication gap that has been found between the normal persons who can talk and speak in language that he/she knows and those personal who cannot speak because they are disabled with hearing impairment.

Urdu Sign Language Detector (USLD) is basically divided into two stages, first step is 'text to sign' and the other step is 'sign to text'.

The research work only focus on detection of Urdu Sign language. The research on Urdu sign language detection is not done yet; selected Sign language is Urdu which is popularly known as Pakistan sign language (PSL) or Urdu sign Language (USL).

Sign Language

A sign language (also signed language) is a language which, instead of acoustically conveying sound patterns, uses manual communication and body language to convey meaning. This can involve simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions to fluidly express a speaker's thoughts.

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Wherever communities of deaf people exist, sign languages develop. While they utilize space for grammar in a way that oral languages do not, sign languages exhibit the same linguistic properties and use the same language facility as do oral languages.

Figure 1: American Sign Language (ASL)

Hundreds of sign languages are in use around the world and are at the cores of local deaf cultures.

Signed languages are as old as history. They are not new languages recently invented. Like spoken languages, they developed naturally. Deaf people needed to communicate with those around them. Certain gestures became commonly understood and in time, as with spoken languages, a rich vocabulary and grammar structure developed. Like spoken languages, sign language is drive languages from it natural languages. They change as the people who use them change. Figure 1 show symbols of Sign language [1], [2].

Urdu Language Sign Language

The native language of Deaf community is their signed language, which is different and unique in every country. Currently, there exists very little resource material available in dictionary form to assist students in strengthening the language skills necessary for academic achievement.

To bridge this gap, Deaf Reach has begun developing a digital PSL video dictionary. Once complete, a standardized language resource will be developed for deaf students, the parents and an invaluable tool for all those involved in Deaf education, greatly aiding in the training of teachers and interpreters for the Deaf.

There are several types of sign languages that exist in the world but two of them on which much work has

been done previously for the Sign detection are American Sign Language (ASL) and British Sign Language (BSL).

The sign language which focus on this research work is widely used in Pakistan popularly known as Pakistan Sign Language or Urdu Sign Language, although in Pakistan there are different types of Urdu sign languages exist in different parts of country, This research focus followed the standard that has been introduced by ABSA (Institute for Deaf People in Karachi Pakistan) and many of the popular institutes are following it in Pakistan [3].

Figure 2: Urdu Sign Language (USL)

II. Necessity of the Application

Today communication between deaf and non-handicapped people is very difficult. It can only be possible if the non-handicapped person can handle the sign language, or the deaf person communicates loud and clear (if possible).

At the moment there is no electronic device or service that enables communication between both in the way, that the deaf person uses sign language and the non-handicapped person use their natural Language.

In Social interaction deaf persons need to communicate with their own culture (i.e. Deaf-to-Deaf Communication) and also interact with normal persons in daily life.

Therefore two types of communication model is exit for Deaf persons:

- Deaf-to-Deaf (DTD) Communication Model
- Deaf-to-Normal (DTN) Communication Mode

The DTD Communication Model is comfortable for deaf persons. In this model they communicate in their own cultured language i.e. sign language.

The DTN Communication Model is difficult for deaf persons to interaction with normal persons in daily routine. They faced lot of problem to communicate with normal persons. Because normal persons are not aware with sign language. Normal person with hearing blessed also feel frustration to communicate with deaf persons, especially when there is no interpreter between them. They have communication barrier with deaf persons [4].

III. Proposed Application to Detect Urdu Sign Language (USL)

The proposed research detection of sign language is work on two functionalities one is Text to Sign conversion and the other one is Sign to Text conversion (see figure 3).

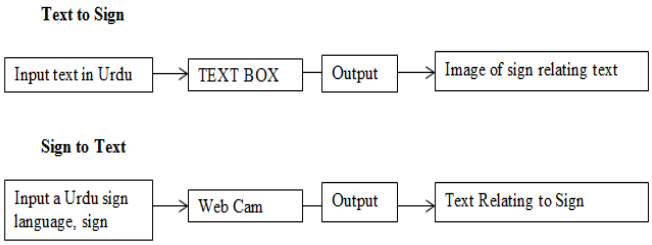


Figure 3: Process diagrams of proposed application

In this research work object detection technology will be required to make sign detectable. For image detection many image processing and computer vision applications require to extracting information from images.

In a lot of applications, however, extracting a huge amount of features from data is forbidden due to time limitations. This limitation is even more severe when dealing with video data in which features are extracted from a large amount of images.

Haar object detection is used in the research work; this is consistent way to detect sign language characters. Haar object detection method is basically use for digital image features using object recognition technique.

Haar-like features are digital image features used in object recognition. A Haar-like feature Algorithm considers adjacent rectangular regions at a specific location in a detection window, sums up the pixel intensities in each region and calculates the difference between these sums. This difference is then used to categorize subsections of an image. The position of these rectangles is defined relative to a detection window that acts like a bounding box to the target object.

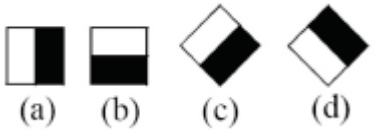
The key advantage of a Haar-like feature over most other features is its calculation speed. Due to the use of integral images, a Haar-like feature of any size can be calculated in constant time i.e. 60 microprocessor instructions for a 2-rectangle feature .

A simple rectangular Haar-like feature can be defined as the difference of the sum of pixels of areas inside the rectangle, which can be at any position and

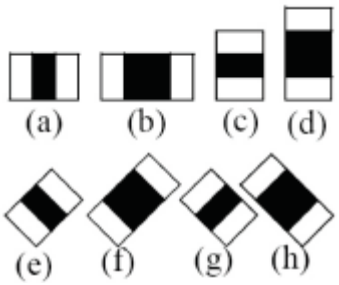
scale within the original image. This modified feature set is called *2-rectangle feature*. The values indicate certain Characteristics of a particular area of the image. Each feature

type can indicate the existence (or absence) of certain characteristics in the image, such as edges or changes in texture. For example, a 2-rectangle feature can indicate where the border lies between a dark region and a light region [5].

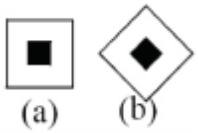
Edge Features



Line Features



Center-Surround Features



Haar Features

IV. Implementation of Proposed Application

In this research work Urdu text box is implemented by following a phonetic style of keyboard which formed by a unique code for each alphabets from keyboard, which help in detection of Urdu Sign Language.

An Emgu.cv.dll is used for working on webcam detection, Emgu.cv.dll provides the platform for image processing, and it allows OpenCV functions in .Net combatable languages such as C #, VB, VC++ etc. while Open CV is a high performance image processing library by Intel.

Harr training is used to make Urdu Sign Language detectable. It a long process includes several steps to make sign detectable as below:

Step1 : First of all it is trained with a few hundreds of sample views of a face.

Step2 : After a classifier is trained, it can be applied to a region of interest in an input image.

Step3 : The classifier outputs a "1" if the region is likely to show face and "0" otherwise.

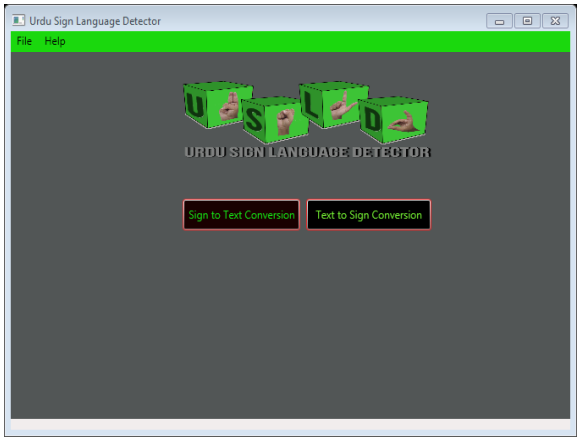
Step4 : To search for the object in the whole image, one can move the search window across the image and check every location using the classifier.

Step5 : The classifier is designed so that it can be easily "resized" in order to be able to find the objects of interest at different sizes, which is more efficient than resizing the image itself.

First we need lots and lots of images about hundreds, of a single signs with little bit of variations then we have to work on these images to extract coordinates from these images manually working on each image and there are negative images coordinates we need to extract and by negative we mean images without sign. All the coordinates are collected in respected files positive and negative coordinates then to give that coordinates meaning by meaning we means the detection, we have to process it in Haar training and it takes about 4 to 5 days depending upon the continuous running of the computer system.

The primary purpose of this project was to reduce communication gap between normal person and deaf persons using our two modules in this project first is sign to text and the other one is text to sign. While the important part of this project was the sign detection using webcam, we are able to detect signs although we have not completed all the alphabets signs.

Figure 4: First Screen



Character Detection

Press any character using keyboard and then it will load image on picture box and display sign accordingly otherwise it will display blank when an inappropriate key is pressed.

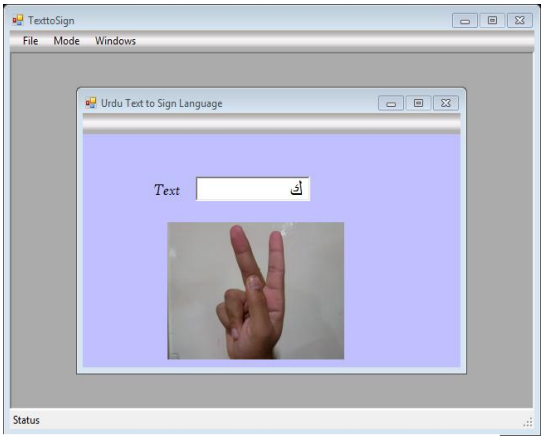


Figure 5: GUI for Character Detection

CHARACTER DETECTION CODING

```
private void urduTextBox_TextChanged(object sender,
EventArgs e)
{
string filename = urduTextBox1.Text;
try
{
if (urduTextBox1.Text.Length > 1)
{
if (!string.IsNullOrEmpty(urduTextBox1.Text))
{
this.urduTextBox1.Text = string.Empty;
}}
else
{
stringloadimage = "Resources\\" + filename + ".jpg";

pictureBox1.Load(loadimage);
}}
catch (Exception)
{
pictureBox1.Invalidate();
pictureBox1.Load("image.jpg");}}
```

Code: Character Detection

Sentence Detection

The below coding depicts whatever we type. It takes last word and matches with resource and displays the image on panel

Sign detection Through Webcam

Figure 6: GUI for Sentence Detection

Character Detection Coding

```
private void urduRichTextBox1_KeyUp(object sender,
KeyEventArgs e)
{
try
{
if (e.KeyCode == Keys.Space)
{
count++;

var words = urduRichTextBox1.Text.Split(new string[] { " ", ".", "" },
StringSplitOptions.RemoveEmptyEntries);

ADD_hand_Found(words[words.Length - 1]);
}
else if (e.KeyCode == Keys.Back)
{

if (panel1.Controls.Contains(PI[count]))
{

Panel1.Controls.RemoveByKey(count.ToString());

if (panel1.Controls.Contains(LB[count]))
{
Panel1.Controls.RemoveByKey(count.ToString());
count--;
}
if (hand_count == 0 &&hand_panel_Y == 100)
{
hand_panel_X = 425;
hand_panel_Y = 0;
hand_count = 5;
}
else if (hand_count == 0 &&hand_panel_Y == 200)
{
hand_panel_X = 425;
hand_panel_Y = 100;
hand_count = 5;
}
else if (hand_count == 0 &&hand_panel_Y == 300)
{
hand_panel_X = 425;
hand_panel_Y = 200;
hand_count = 5;                    }
else if (hand_count != 0)
{
hand_count--;
hand_panel_X -= 85; } } } } catch (Exception)  {       } }
```

Code: Character Detection

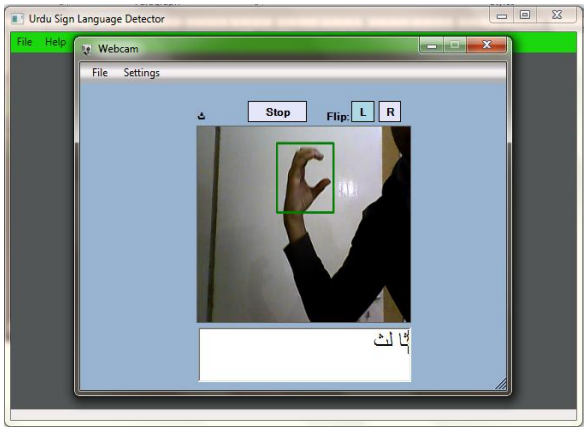


Figure 6.1: Sign Detection through Webcam

Figure 6.2: Sign Detection through Webcam

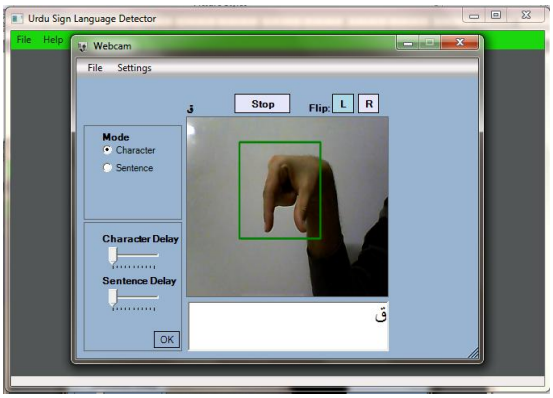


Figure 6.3: Sign Detection through Webcam

Webcam detection coding

```
//return meaning according to the sign

voidFrameGrabber_Standard(object sender, EventArgs
e)
      {
if (currentFrame != null)
           {
gray_frame = currentFrame.Convert<Gray, Byte>();
HandDetected = gray_frame.DetectHaarCascade(_hand,
1.2, 10,
Emgu.CV.CvEnum.HAAR_DETECTION_TYPE.DO_
CANNY_PRUNING, new Size(24, 24));
if (HandDetected[0].Length == 1)
               {
id = 1;
MCvAvgComp hand = HandDetected[0][0];
if (flag[0] >= 5)
                  {
currentFrame.Draw(hand.rect, new Bgr(Color.Green),
2);
for (inti = 0; i< 26; i++)
                     {
if (i == 0)
continue;
flag[i] = 0;
                     }
dflag = 0;
                  }
if (flag[0] == 5)
                  {

                     label1.Text = "ی";
   }}}}
```

Code for Sign Detection through Webcam

V. CONCLUSIONS

The detection of Urdu sign language using Haar Algorithms is a best way to identifying the character of Urdu sign language even one can also identify the whole word. Globally there is no work on Urdu sign language this research contribution will help to boost this work in future. Practically this requires some special environment to be able to work properly to detect Urdu sign language through webcam. There must be good lighting conditions in the room where the project is to be displayed. The background should be white where detection is to be performed. The hand from which one will be making sign should be in front of webcam in a line not above not below the webcam but it has to be inline. If theses specifications are followed correctly then there is no way this project cannot work correctly.

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