

PUZZLE PORTAL: AN IMAGE PROCESSING BASED GAME TO IMPART KNOWLEDGE THROUGH PICTURE PUZZLES

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Abstract

This paper presents an innovative application of image processing in the form of a game. We have used image processing extensively to create an innovative, interesting and informative game called Puzzle Portal. In this game we aim to impart knowledge to the user through various picture puzzles created in the game. There are many sections that player can select to play viz. entertainment, logos and educational sections which are further subdivided into many categories. The GRE words can also be learnt easily by the user by using Puzzle Portal. General knowledge can also be studied using this game. The main feature of puzzle portal is that the entire database is ingeniously created to cater to all the age groups. Puzzle Portal has image processing as its base wherein any image is processed and displayed to the user. The user has to guess the image and type the guessed answer. Correct answers will fetch him points and thus scoring makes it competitive. This game is very interactive due to its user friendly GUI. Puzzle Portal is not only a game to be played for fun but also a learning process that happens during playing.

Keywords: GRE, image processing, Morphology, picture puzzles.

A.Introduction

Pictures are the most common and convenient means of conveying or transmitting information. A picture is worth a thousand words. They portray spatial information that we can recognize as objects. Human beings are good at deriving information from such images, because of our innate visual and mental abilities. About 75% of the information received by human is in pictorial form. Visual memory lasts longer than the memory which is perceived through our eyes or ears. We have tried to utilize this ability of human in the best possible way and provide them knowledge and entertainment with the help of a game. Puzzle Portal is a blend of MATLAB based image processing and MATLAB GUI operating together to give a very interesting and fascinating mindblending game. It introduces us to a set of images which comprises logos of multi brand companies, resorts, business firms, fashion brands. These images are presented

to the user in their morphed form. The images are morphed with the help of MATLAB functions used one at a time or combination of functions. The user can check whether his given answer is right or wrong. Apart from the entertainment section there is a section for graduate record examination (GRE) word list. The words are presented along with an image which can be commemorated and hence easy to recollect. Moreover flags of countries have been presented to the user in the video format using MATLAB video player. The user interface has been built using the MATLAB Graphical User Interface (GUI) which provides the user with an option to enter his answer and validate it. The user gets score points for right answer and points are deducted partially if we need hints; zero points if the answer is wrong and the game continues with the display of original image.

(Disclaimer- The images used in this paper are only for the purpose of showing morphological operations.)

B.Operational Flowchart

1. The game begins with the GUI displaying a "start" button.
2. The user is then displayed with the various categories amongst which we can choose any one which we want to play.
3. The categories that are currently included in the game are broadly classified as GRE word learning, study related learning, flags, logos, entertainment and historical places.
4. There are various sub-categories such as business firms, Indian brands, fashion brands, hotels, airlines, automobiles, cartoons, movies and personalities.
5. Along with the categories, the user can also select the level we wish to play i.e. level 1(easy) or level 2(difficult). The levels are segregated according to difficulty.

The following flowchart illustrates the flow of operation of the game Puzzle Portal at the user's end:

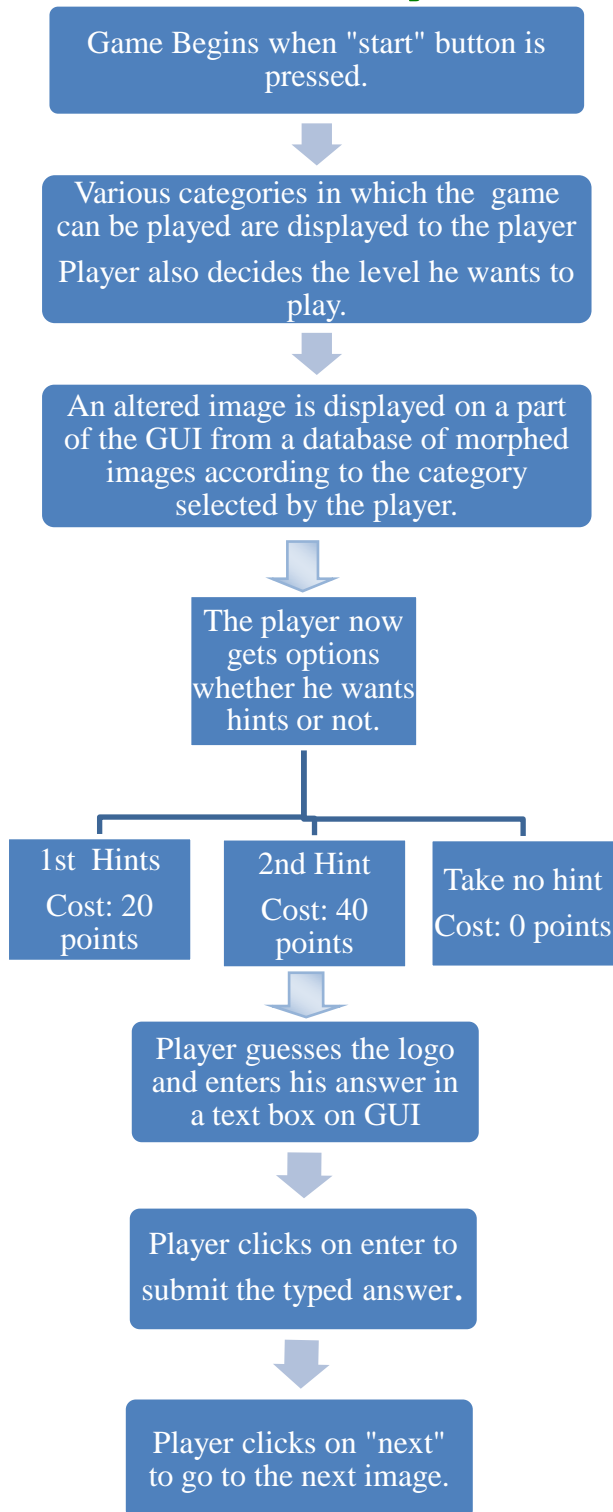


Figure 1. Operational Flowchart

There are 4 different operations that take place according to category:

For logos, entertainment and historic places:

The altered image from the selected category and sub-category is displayed [9]-[11]. The player is asked whether we need a hint. There are 3 options to it:

- The first hint, it reduces the current score by 20 and displays some information about that picture which will help the player to guess the image.
- The second hint, it reduces the current score by 40 and displays half of the word to assist the player in guessing the remaining half word.
- If the player does not want any hint we can proceed by clicking this third option and no reduction in score is done.

The player guesses the answer, types the answer in the edit window provided and clicks enter. This submits the answer to be verified. If the answer is correct then the original image is displayed in the window and the score is increased by 100 points. If the answer is incorrect then original image is not displayed and the score is not updated. Clicking on the "next" button takes the player to the next altered image. The game continues till the images in that level do not get exhausted. The player can go back and select any other category and continue playing the game.

For Flags:

The flags section is a memory game. The flags are displayed three at a time one after the other in the video mode of MATLAB inbuilt GUI. The player must guess all three flags in correct order of their appearance to get full 300 points. Partially correct answer will fetch partial points. One correct answer gets the user 100 points and two correct guesses fetches him 200 points. There will be no points given if the answers are right but the order is wrong. Therefore the player's knowledge and memory both are tested here. For this section there are no hints [12].

For GRE:

This section is used for learning purpose. The GRE words, 5 at a time one after the other are shown along with its meaning and an image that signifies that particular word. This is the reviewing time given to the user. The user may take time to read all 5 words and keep them in his memory. After this only images are shown and the user has to guess the word. This is the learning time given to the user [7]. After learning every 20 words, these words are analyzed again. Guessing the words correctly fetches 100 points. GRE words database has been extensively extended to 100 words to give the exact understanding of how the system will work.

For Studies related:

This section is for learning purpose. Here, we have included the complex chemical reactions to be learnt by the students during their exams. The complex reactions are not easy to remember and recollect so putting them in a pictorial form makes it easy to learn. The student reviews, learns and revises the reactions/equations for any number of times till we learn them thoroughly. If the user wishes to exit the game at any point of time during its execution, we can click on “exit” button and end the game instantly.

C. Related Work**I.Database**

For making Puzzle Portal, we need to have large database of images [6]-[12]. We had to make two different image databases one for original images and the other for the altered images or morphed images. To access all the images at a time we need to collect them in one such pattern from where we can access them at a single time rather jumping to the database folder every now and then. We used structures for this purpose.



Figure 2. Original image of a logo



Figure 3. Morphed Image using image processing

Structure is an array-structure which creates a tabular database with the file name as one of the parameters. The additional parameters are date, time, bytes etc. the structure makes any parameter accessible at any point of time in the code [4]. We can refer to every object different and therefore it is easy to use and apply even for very large databases.

To get the results in an M-by-1 structure, use a syntax like `ans=dir(file_obj)`.

This syntax returns a structure like the following:

`ans =`

1x5 struct array with fields:

Name

Date

Time

Bytes

Isdir

Where,

- name — Name of an object in the folder, shown as a cell array. The name, stored in the first element of the cell array, can have up to eight characters. The three-character file extension is stored in the second element of the cell array.
- date — Date of the last save of that object
- time — Time of the last save of that object
- bytes — Size in bytes of that object

In this way, structure was used to make database for image for all the categories in the game.

ACCRETION

Meaning – increase by external addition or accumulation.

Synonyms – increase, accrue, growth.

Figure 4. Specimen database for GRE word-accretion(with meaning and synonym)



Figure 5. Specimen database for GRE word-accretion(without meaning and synonym morphed(cropped))

II. Image Processing

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it [1]-[3]. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be an image or characteristics associated with that image. Usually Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them [5] .

Image Processing Toolbox of MATLAB provides a comprehensive set of reference-standard algorithms, functions, and applications for image processing, analysis, visualization, and algorithm development. We can perform image analysis, image segmentation, image enhancement, image denoising , geometric transformations, and image registration.

Techniques of Image Processing used in the game [15]

i. imcrop

Syntax = imcrop(I,[75 68 130 112])



Figure 6.Specimen original image



Figure 7.Specimen morphed image using imcrop

ii. fspecial

Syntax= fspecial(type, parameters)



Figure 8.Specimen original image



Figure 9.Specimen morphed image using fspecial

iii. im2bw



Figure 10.Specimen original image Figure 11.Specimen morphed image using im2bw

iv. strel Syntax = strel(shape, parameters)

It creates a structuring element, SE, of the type specified by shape. Depending on shape, strel can take additional parameters. Shapes comprises disk, square, rectangle, octagon and many more [5].

v. Imclose Syntax= imclose(I,SE)



Figure 12.Specimen original image



Figure 13.Specimen morphed image using imclose

vi. Imdilate Syntax= imdilate(I,SE)



Figure 14.Specimen original image



Figure 15.Specimen morphed image using imdilate

vii. **imtophat**

Syntax= imtophat(I,SE)

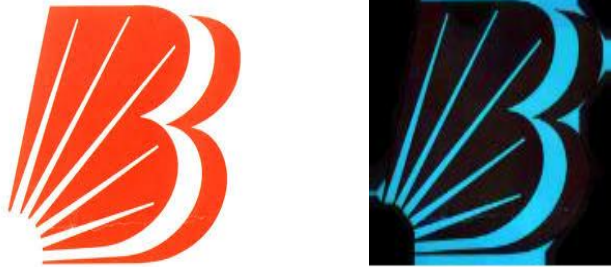


Figure 16.Specimen original image

Figure 17.Specimen morphed image using imtophat

viii. **imerode**

Syntax= imerode(I,SE)



Figure 18.Specimen original image

Figure 19.Specimen morphed image using imerode

ix. **imfilter**

Syntax= imfilter(A,h)

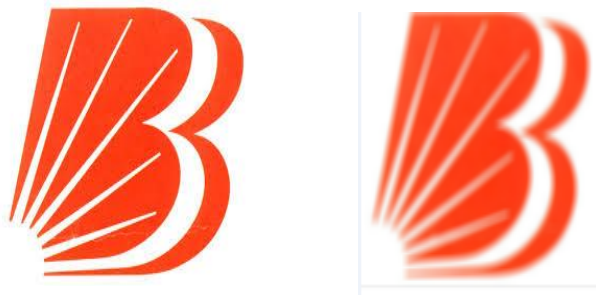


Figure 20.Specimen original image

Figure 21.Specimen morphed image using imcrop

III. **MATLAB GUI**

For user to play a game, the game needs to have an interactive and easy-to-use environment. To make Puzzle Portal more user friendly, its front end look was developed using the MATLAB [13]. GUIDE (graphical user interface design environment) provides tools for designing user interfaces. Figure given are examples of some of the GUIs of Puzzle Portal [14].



Figure 22.The first GUI that appears when Puzzle Portal starts.

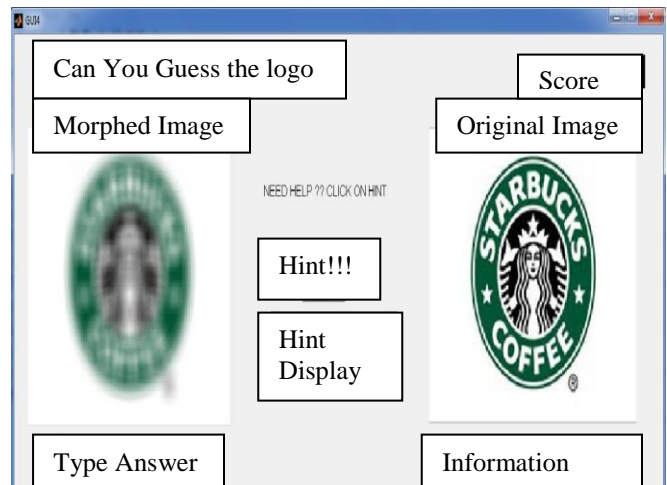


Figure 23.The GUI when Puzzle Portal is being played by the user [16].

D. RESULT

The project Puzzle Portal was implemented on MATLAB. It was basically executed to be a MATLAB based game wherein MATLAB was extensively applied in every step.

The following images are the screen shots of the MATLAB implementation of Puzzle Portal.

```
enter the game you want to play,
1) logos
2) flags
3) historic places
4) entertainment
5) gre/apti
6) studies
```

Figure 24.Various categories appear as the game starts

```
1
a =
1

Enter the category you want to play,
1) business
2) social media
3) automobile
4) fashion brands
5) beverages
6) hotels
7) indianbrands
8) airlines
9) Electronics 3

a =
3
```

Fig 25. Various sub-categories that appear under the category logos.

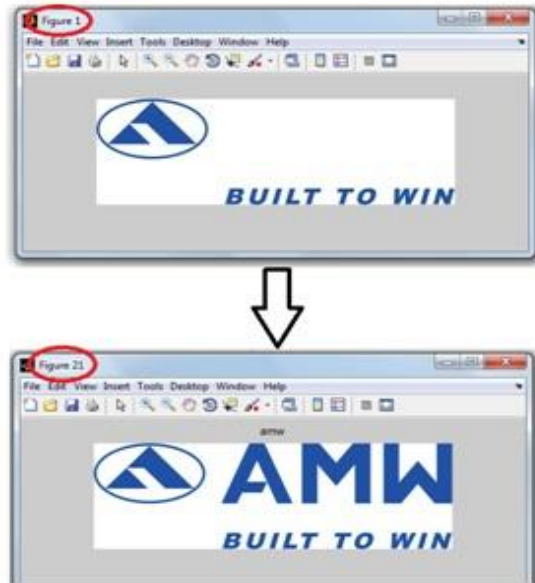


Figure 26. Displaying morphed image for the user to guess the name and displaying original image along with name on correct answer [17].



Figure 27.First page of the game on GUI along with Puzzle Portal logo



Figure 28. Displaying categories on GUI



Figure 29. Displaying sub-categories on GUI.

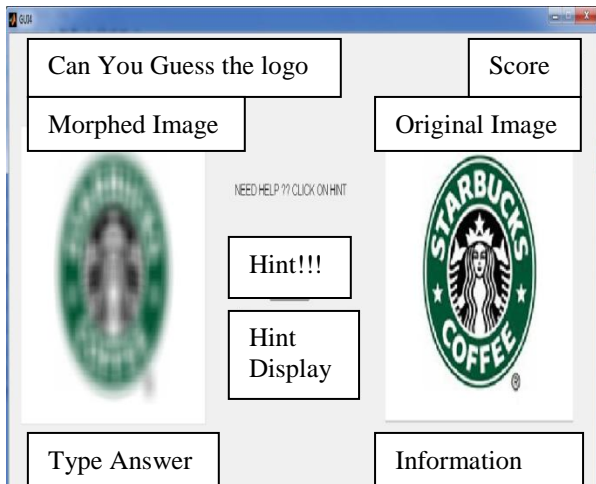


Figure 30. Displaying the morphed image for user to guess and displaying original image on correct answer using GUI [16].

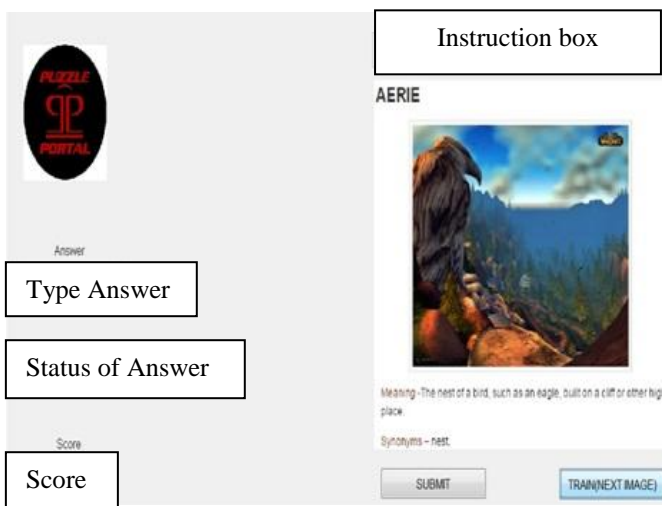


Figure 31. GUI implementation of GRE words(training).

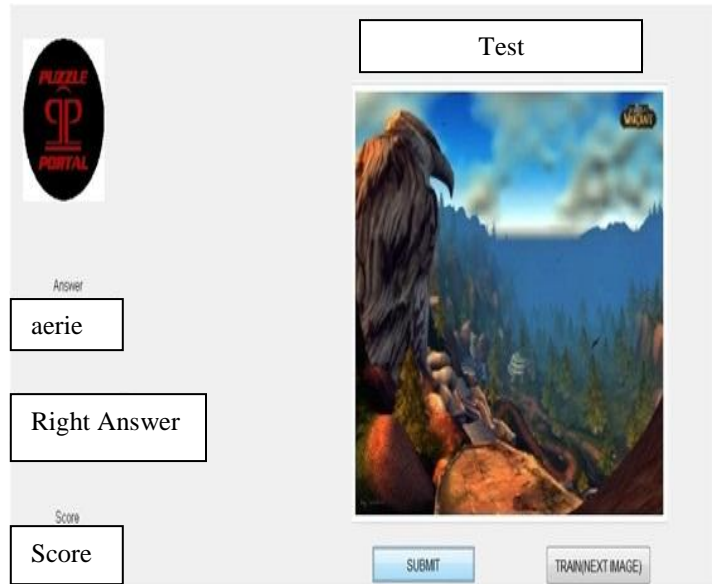


Figure 32. GUI implementation of GRE (revising).

E. Future Scope

The database of images can be expanded at any time to make the game more interesting and enlightening.

The Game can be made platform independent (eg. C, C++, Java) so that it can be operated on any PC, Ipad, Iphone, macbook, Android phones, etc.

Android/IOS application of the game can be made and re-leased in android/IOS market. Categories and levels of the game can be increased as game updates in the store.

The study section of the game including GRE, mathematics and chemistry can be extended on a wide scale for any subject making the game more useful for colleges, schools, students, etc. Game levels can be made for nursery and primary level children too.

Also the game can be made multi-player and the scores of two or more players can be compared for fun and entertainment.

F. Conclusion

Ultimately, most of the Puzzle Puzzle project goals were achieved and infotaining game was successfully created. Despite the fact that computer based gaming is one of the fastest growing entertainment industry branches, there is

remarkably little data on the development of games based on knowledge and studies; and these games have less impact on adults. Market researchers also tend to focus on games that can be informative along with entertaining just like Puzzle Portal. Puzzle Portal is a blend of MATLAB based image processing and MATLAB GUI operating together to give a very interesting and fascinating mindblending game. Using various concepts of database, various methods of image processing, and various techniques of creating GUI Puzzle Portal was made which is not only a fun loving game but at the same time it provides us with various information about the present world scenario and various categories which we have included in our project, thus making it an easy and fun loving to learn. Also this game helps in understanding the consumer perception on brand awareness and position of product in the market. The Study section including mathematics, chemistry, GRE will help college students to learn their subjects in an interesting way through a game. The game helps to increase the know-how of a common man about various brands and products available in the market making him more acquainted. This user friendly, informative, innovative game can be enjoyed by any age group.

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Biography

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