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West Indian Folk Music Analysis

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Abstract:
This paper extract the features of folk music of west region of India with consideration of elements of music such as duration, dynamics, harmony, melody, structure, texture and timbre of folk songs. This paper also helps to improve the performance of the folk songs.

Keywords: Dynamics, Harmony, Melody, Structure

Introduction:

Maharashtra is west region of India with its great music tradition. In rural community of Maharashtra many occasions are celebrate with music and dance. This music has various forms such as devotional music, folk music and classical music. Folk music is exceedingly famous in Maharashtra like Povada, Lavni, Bhaleri, Owi, Abhangas, Kirtan, Lalita, Tumbdi, Bharud and Gondhal. These are main and trendy folk songs to engross rural community.

Mostly Indian folk music has a raw sugariness that is hard to define. Numerous mystical sounds heard in folk music across India are because of unique arrangement and assembly of handmade instruments. This type of music is not easy to analyze. Any music can be composed at several layers using following elements that describe style or type of music.

- **Duration**: Define length of song
- **Dynamics**: Define sound of song
- **Harmony**: Vertical arrangement of song
- **Melody**: Horizontal arrangement of song
- **Structure**: Define section of song
- **Texture**: Define music density

In this paper we were able to find all above values using computing techniques.

Music Analysis System:

In this system 250 West Indian folk songs are stored in database. This system was divided into four tools to extract the information of West Indian folk music. To analyze folk songs we need music sheet. With ScoreCloud Studio, notation appears automatically when we play any songs from the database. First tool was used to find duration and tempo of folk music using Mutagen. It was a Python module to handle audio metadata.

Second tool was used to classify soft or loud volume of folk songs using Hidden Markov Model. This model was implemented in python. The classification of dynamics is as follows

Dynamic Level	Meaning
p or piano	soft
f or forte	loud
mp	moderately soft
mf	moderately loud
pp	very soft
ff	very loud

Third tool was used to classify melody of folk music using Hidden Markov Model. The Baum-Welch reestimation method was implemented to train a hidden Markov Model for each category of songs of an unknown melody. The Viterbi algorithm was used to decode the sequence and compute the log probabilities using trained data for different songs. We assign the melody to the categories of the songs with highest log probability.

Fourth tool was used to find structure of folk music. Musical Structure describes how a piece of music is constructed in terms of distinct sections within the piece. This shows rhythm, timbre and chroma of music. Firstly the rhythm structure of the music was analyzed by detecting note onsets

and the beats. The music is segmented into frames with the size of inter-beat time length. We call this segmentation method as beat space segmentation. Secondly, a statistical learning method was used to identify the melody transition via detection of chord patterns in the music and detect singing voice boundaries. Finally, with the help of repeated chord pattern analysis and vocal content analysis, the music structure is detected. Every generated data such as Duration, Dynamics, Melody and structure of music were stored in database.

Result:

In Musical Analysis System, First tool was able to detect duration of different folk songs. Second and third tools were able to classify the volume of sounds and melody with an accuracy of 90% and 67% respectively .The Classification problem becomes harder when we stored more different types of West Indian folk songs.

Conclusion:

Folk music was stored in MIDI format. Two classification methods were used. These two classification methods were based on histograms to represent folk songs and achieve a classification accuracy of about 90% and 70% respectively. Using these data we can improve the structure of folk music.

Future Work:

In future work would include detection of the texture and harmony of West Indian folk music.

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Traffic Control System using RFID

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Abstract: The present scenario of traffic violations is increasing rapidly. It gives rise to major problems that are beyond human control directly and therefore there is a need of automation. This paper deal with traffic control system using RFID technology to identify the vehicles which break the traffic rules.

Keyword: RFID tag, RFID Module, RFID reader, Traffic Signal

I. INTRODUCTION

India is the biggest populated country. Nowadays peoples are facing traffic issues like time, congestion and pollution and road accident due to poor maintenance of the roads or inpatients of human behaviour. There is very slightly awareness of road safety and traffic laws are wilfully violated. In the growing of mechanical era traffic also in increasing mode. This system tries to control the breaking of traffic rules using RFID(Radio-frequency identification) technology.

II. LITERATURE REVIEW

An Intelligent traffic control system using RFID Anuran Chattaraj, Saumya Bansal, Anirudhha Chandra, 2009. :-In this paper RFID tags are attached with vehicles and RFID reader is used to count vehicles number. According vehicles count .microcontroller change the signal. This system does not provide any emergency condition for passing ambulance.

Intelligent cross road traffic management system (ICRTMS) : Ahmed S. Salama, Bahaa K. Saleh and Mohamad M. Eassa, 2010.: -This system gives alert signal about the emergency situation using RFID technology.

Design of Intelligent Traffic Light Controller : J R Latha, U Suman, 2015. :- This system uses GSM interface , serial communication interface (SCI), Real-Time Clock 1307 and a clock circuit. To detect traffic using sensor signal with maximum accuracy but this system is not compatible for higher distance traffic.

An Integrated Traffic light Control System Using RFID Technology and Fuzzy logic: Javed Alam and Prof. (Dr.) M. K. Pandey:- This system uses RFID technology, Simulation in MATLAB and fuzzy logic.

III. METHODOLOGY

Basically RFID uses electromagnetic fields to automatically recognize and track the tag attached to things. In this RFID system following components are used:

8 RFID modules, Arduino UNO Arduino Mega 2560, Red LEDs (4 pieces), Yellow LEDs (4 pieces), Green LEDs (4 pieces),220ohm resistors (12 pieces), Jumper cables, Breadboards, MFRC 522 RFID Module, 3 X 220-ohm resistors, Buzzer, RFID tag, IR Transmitter & Receiver Sensor. The RFID tag holds a chip for storing information about the physical object and an antenna to receive and transmit a signal. RFID tags can usually store 1KB of data. An RFID reader produces a high-frequency electromagnetic field and when the tag comes near it, a voltage is induced. This induced voltage turns as power for the tag. The tag return converted the signal in power and responds to the reader.

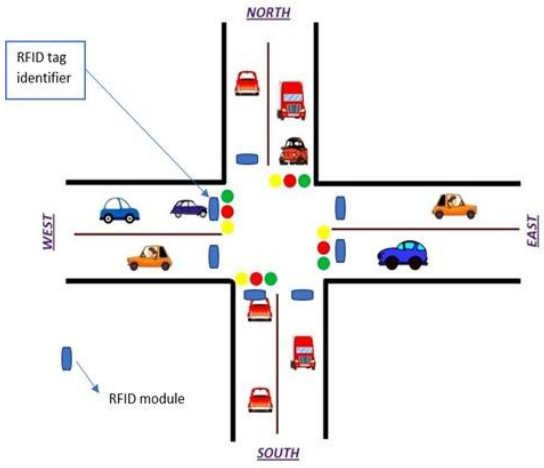

Fig. 1. Traffic Control System

In this system 8 RFID modules are used to read the vehicles which are coming from any direction. .RFID reader is placed on a road at zebra crossing. When any vehicles pass by following signal rules , RFID reader reads RFID tag which is attached to vehicle's and that vehicles data added into database. If vehicle's does not follow signal rules and passes then that data store in database and send the warning and fine messages to a registered mobile number.

IV. CONCLUSION

In this system, RFID technologies are used to monitor real-time traffic information. This system is good enough to track the information about vehicles which break the traffic rules and help to collect the passing vehicle data that break the traffic rules. A warning message can be sent to a registered number with a penalty receipt.

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2. A Review of Human Activity Recognition using AI Based Algorithms

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Abstract

'New Normal' introduced by Pandemic situation is maintaining social distance, wearing a mask, maintaining hygiene. These human actions can be classified using Computer vision. This justifies the need of Computer Vision which is leading technology rapidly taking over the entire world. For this we need to focus on real world images of human activities. Human Activity recognition refers to sensing human actions and design the goal to bifurcate these activities into two classes namely, static and dynamic traits. This study covers formation of images dataset such as CHARADES and WIDER. In this review paper it focuses on Human Activity Recognition using Artificial Intelligence based algorithms. Based on input methodologies Human Activity Recognition can be classified into three categories such as shape based, sensor based and mixed approach. It has been found that features such as background clutter, viewpoint and occlusion play important role in Human activity recognition. Shape-based classification using SVM, CNN, ANN and DNN algorithms shows more than 80% accuracy than statistical techniques and newly designed algorithms such as Tool.

Keywords: Computer Vision, Human Activity Recognition(HAR), CHARADES, WIDER

Introduction

We the human beings perform various activities either consciously or unconsciously. These measurable actions are referred hence forth in the paper as activity(Mannini & Sabatini,2010).

At present Human Activity Recognition (HAR) has become popular and emerging research area considering its applications in different domains like Human Computer Interactions, Gesture recognition, Posture recognition, Face recognition, Object Detection, etc. Human activities are classified into two traits static and dynamic. Static traits include postures like lying, sleeping, standing, sitting, and waiting etc. Dynamic traits include exercising, falling, running, walking, walking stairs up and down etc(Mannini & Sabatini,2010).

The present paper is an attempt to review the existing literature on HAR. The research papers published between 2000 to 2020 are considered.

HAR emphasizes on identification and separation of objects and subjects from background. It turns out that background clutter, viewpoint, images and videos database consistency affect the recognitions.

Figure 1

Algorithms used for HAR

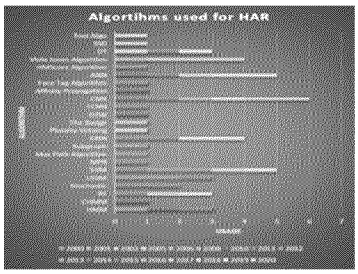

Figure 1 depict different algorithms used in research papers for HAR from 2000 to 2020. The chart clearly indicates the dominance of AI(Artificial Intelligence) algorithms like CNN(Convolutional Neural network), ANN(Artificial Neural network), DNN(Deep Neural Network) and some of its variants. Few newly established algorithms such as SSD(Single Shot Detector), Tool, and MPR(Motion Part Regulation) are gaining popularity. In early 2010, using Sensor based approach the emphasis was on statistical measures like accuracy, precision, recall as well as algorithms like RF(Random Forest), Decision tree(DT), Dynamic Time Wrapping(DTW), Affinity Propagation. But, after 2015 smart activity trackers received attention and the focus was on SVM and ANN. In case of shape-based approach SVM, LSVM was taken into consideration but Viola Jones algorithm of Object detection worked as a benchmark and growth of AI, ML and DL algorithms grabs the attention of researcher towards it.

Figure 2

Types of HAR Input Methodologies

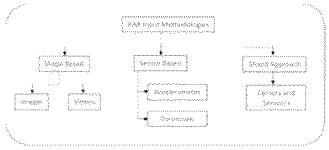

Figure 2 shows different input methodologies of collecting human actions. Main categories are shape-based and sensor-based. Mixed approach is the hybrid approach for considering human motion analysis using camera which has built in sensors for capturing images. As of now lots of datasets are publicly available such ImageNet, WIDER and its version which gives good opportunity to a researcher in the area of data pre-processing, data analysis, data recognition related to human actions.

In the next section, year-wise growth of methodologies and usage of different algorithms for shape-based categories as mentioned above are reviewed.

Literature Review

HAR has been a challenging problem since last so many years yet it needs to be solved with the help of optimized AI algorithms. So far it has been mainly explored in elder care and health care as an supportive or assistive technology.

Since last half and year humanity has seen a worst pandemic ever with increasing need to detect human actions which can be used in fields like face mask detection, detecting crowd gathering and various violations of social distancing rules and many more.

Initially the research work was done based on the broad category i.e shape-based and sensor-based. Later on during research new approach was found using fusion of sensor data. This paper covers review of research work from 2000 to 2020 which includes algorithms used for HAR. A trend has been observed statistical methods, Classification algorithms, SVM and its variants and AI algorithms like ANN, CNN, DNN. In last 2 years generation of new algorithms and systems like Tool, VEDA, etc.

The next subsection covers year-wise trend of algorithms implemented in area of HAR.

A. Sensor Based Approach

(Jayalath et.al.,2013) developed the Step Detection Algorithm which gives an accuracy of 96% for slow-walking on flat land, 95% when walking up and down the hill and 90% when going up and down the staircases. Similarly, more than 10 papers over the year 2010 to 2016

came out with the features like gyroscope fails to detect vertical movement. This paper will focus on shape-based feature extraction instead of feature exploration for sensor-based approach.

B. Mixed Approach

Mixed approach makes use of camera. (Casale et. al.,2009) build a socially aware device "The Badge" that learns from user's activity using accelerometer and camera, Total 13 data sequences between the range of 10 to 15 minutes were collected. 10 out of 13 were used as training dataset. 6 out of 9 activities were correctly classified. Face detector had the classification rate of 0.928. There will be possibility of feature analysis using mixed approach.

C. Shape Based Approach

From the study it has been observed that more than 20 years of research had been completed for shape-based approach. Pre-recorded Images and videos were studied under this approach using AI algorithms and by developing some new algorithms.

A method to recognize two-person interactions using upper bodies and heads from 300 video clips of 23 TV shows was developed by (Patron-Perez et. al,2012). A KLT tracker is used along with clique partition (CP) clustering to form tracks which were bounding boxes. SVM detected head position in frame with an accuracy of 72.03%. A full structured approach performs better than LC(local Context) approach in which accuracy was improved from 70% to 84%.

Authors of (Lan et. al,2012) developed a hierarchical min-max framework for HAR. Two annotated datasets, Broadcast field Hockey video and nursing home were studied. Using LSVM the average person detection on hockey dataset was 33.67%. The challenge in structured SVM is loss augmented inference. The detection rate increased by 1.5 for event and doubled for role and action. Low framerate and spatial resolution made Nursing home dataset event recognition a bit difficult.

Chen and Grauman proposed an algorithm in (Chen & Grauman, 2012). Three datasets namely UCF-Concat, Hollywood uncropped and MSR Action were used and upshot method was applied. A maximum-weight connected subgraph was designed. A subgraph method allows to detect activity with best speed or accuracy for all dataset and Increased search scope increases the accuracy of activity detection.

Tran in (Tran et. al.,2013) developed a novel approach for video event detection using max-path algorithm which follows spatio-temporal path. This approach was applied on UCSD

abnormal event detection dataset, NTU-UIUC walking dataset, on KTH for training and on NTU for testing running activities. It requires huge memory as it includes unnecessary background details. Using max-path algorithm accuracy achieved for UCSD improved to 60.20% from 23.98%, walking was accurately classified 73.98% times and running using temporal localization evaluation metric was accurately classified 76.66% times.

The use of CNN for human activity recognitions was demonstrated by Zeng in (Zeng et. al.,2014). CNN algorithm was used in supervised learning approach for analysing static and dynamic traits of HAR. This CNN-based model achieved classification accuracy of 88.19%, 76.83% 96.88% on Skoda, Opportunity, Acti-tracker respectively, which was 4.41%, 1.2%, 9.02% higher than the best algorithm (PCA-ECDF).

(Martinez et. al.,2014) developed an approach which proved that human ratings of emotions treated on consistent scale. Treating ratings as ordinal creates less biased results. Three datasets were Maze-ball (game dataset with 10 features), Synthetic dataset, SAL (sensitive Artificial Listener) with 739 one second speech sequence extracted from 16 videos. A 3 fold validation ANN algorithm was used. Kendal tau value was calculated and maximum of 0.3 is achieved for fun and frustration for PL(Preference learning) with Maze-ball dataset. PL gives better results than CL(Classification learning). Annotations should not be numerical values

Author of (Kuehne et.al., 2014) designed a HTK (Hidden Markov model) framework of human activities. A dataset of 72 hours cooking activities was designed. 52 participants, involved in 10 cooking activities. Context and granularities played important role in video cognition. HTK gives accuracy of 38.46% for overall all cooking activities.

Vrigkas and other researchers had given a complete review on methods of HAR in (Vrigkas et. al. 2015). Unimodal methods, Multimodal methods, Stochastic, behavioural and affective methods for HAR were covered. Research concluded that modelling human pose, handling occlusions and annotating data is the challenge.

Authors of (Ni et. al.,2015) introduced motion part regularization (MRP) framework for dense trajectories and then developed an optimization algorithm for the same. A linear classification model was applied for motion part regularization. A logistic regression function was used as loss functions. It was observed that performance increases with more discriminative motion part but accuracy saturates after 10% discriminative motion parts.

The method followed by Authors of (Ni et. al.,2015) for activity recognition was as follows

1. Get a video clip
2. Extract features
3. Calculate action representation vector
4. Calculate the set bag-of-words by pooling method

MPR gave accuracy of 66.7%, 65.5% and 92.3% for Hollywood2, HMDB51 and Olympic sports datasets respectively. LSVM is costly if latent variables were extracted in large numbers.

In (Yu & Yuan,2015), spatial bounding boxes were studied from video sequences where each student's motion action score was generated. Spatiotemporal redundancy in the videos caused overlapping and average precision of 0.416 was the outcome. A method to developed 3D model from 2D images was proposed in (Oliver et. al.,2000).

A DNN model was developed by (Shao et al.,2015) for crowd detection. WWW (Who, What, Where) dataset used to learn appearance and motion features. For testing ReLU, Sigmoid functions were used in each layer as an activation function. Total 94 crowd attributes were studied from 10,000 videos taken from 8257 crowded scenes. Multi-task learning test all three sets of 'Who What Where' attributes and gives high average AUC score of 0.87. Quantitative and qualitative evaluation was done. Optical flow does not help much in identifying motion patterns in crowd during different scenes.

Authors of (Xiong et al.,2015) developed an effective method for recognizing daily human events from web images using own created WIDER(Web image dataset for event recognition) dataset. Over CNN, FCNN+H+O and FCNN+H achieved 10% better accuracy. Maximum of 75% accuracy was achieved.

In (Sigurdsson et. al., 2016), a public dataset was designed to help object detection in videos, identifying object states, context modelling, video captioning. Here, Hollywood in homes approach was applied. For HAR CHARADES dataset was developed which includes 9848 videos of daily activities, 15 sets of indoor activities, Interaction with 46 objects and 30 verbs with 150 actions. Total 267 people involved from three continents. Authors of (Sigurdsson et. al., 2016), recommended use of Human silhouette for Shape Based Methods.

(O'Mahony et. al.,2019) performed a comparative study of deep learning Vs traditional computer vision. AI algorithms like ANN, CNN and DNN was compared. DNN takes longer time for training a dataset. When datasets are big and high computing facilities are unavailable, traditional methods will come into play.

In Computer Vision Devcon Conference (Abhishek Thakur ,2020), Vladimir discussed the approach to verify that people wear face masks using Deep Learning. An experiment was conducted on WIDERFACE dataset which has 32,303 images and 3,93,703 faces. CNN was designed with three output namely Bounding boxes, Mask or no mask and Faces. Combination of all gives output.

Conclusion

From the above study it can be concluded that HAR has a wide spectrum impact from social life to industrial life. This review explores many areas such as human motion analysis for helping people living in solitary. HAR will also help to regulate health and maintain hygiene during pandemic situation such as COVID.

Taking the research for betterment of society is the only moto of this exploration. Many lacunas found in ongoing research such as viewpoint, background clutter, Occlusion, deviation in accuracy which can be reduced with the help of AI algorithms such as CNN, ANN, DNN.

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Nuances and Repercussions of Virtual Learning Belonging to the Students of Traditional and Professional Programmes

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Abstract: The advent of Covid-19 has created tremendous impact in all spheres of life. The entire world experienced unprecedented halt. It has made technology as integral part of human life in the universe. Pandemic has given birth to the concept of New Normal. It consists of wearing mask, maintaining social distancing and nurturing hygiene through use of sanitizer. Covid-19 affected intensively on public and private sectors such as: business, banks, schools, colleges, tourism and hospitality industry. Schools and Colleges were closed in order avoid spread of virus through mass gathering. This situation created serious dilemmas about the process of teaching and learning in all the educational institutions. There were plenty of challenges in the mind of all the stakeholders in the realm of academics. The teachers as well as students were unprepared to adjust with online mode teaching and learning. Need is the mother of necessity. Therefore, students and teachers commenced the path of exploring new online Applications such as MS Team, Google Meet, Zoom, WebEx. Learning is considered as never ending and ever-changing. There is passionate desire in the mind of teacher and students for smooth teaching and learning in the turbulent time. The prominent challenges faced by the students were: availability of Digital devices, Poor internet connectivity, digital illiteracy and background noise. It was a transition period from Chalk and Talk to technology. This research paper primarily focuses on identification of nuances and repercussions of virtual learning amongst the traditional and professional programmes.

Keywords: Virtual learning; Digital literacy; New Normal

INTRODUCTION

The concept of virtual learning has commenced new horizons in educational institutions all over the world. The use of technology in academia has also increased by leaps and bounds on account of covid-19. According to Britannica [1], virtual learning is the form of education in which students are physically separated from teachers during the learning process and technology is used to facilitate communication between student and teacher or amongst students. Learning becomes more effective when teacher and learner create meaningful interaction about the subject, figure out different perceptions of the subject. Traditional learning method made efforts to construct such possibilities by nurturing critical thinking. In traditional learning students are motivated to enhance their grasping power [4]. It is apparent that traditional system of teaching and learning is capable of inculcation of important skills in the personality of the students. This research paper focuses on use of technology in virtual learning and analyse whether it creates the same impact in learner's mindset or not. It is found that application of technology has become integral part in all spheres of life. Learning is a continuous process and it has found a virtual way to move forward in spite of unforeseen obstacles.

METHODOLOGY

The research methodology for this study includes qualitative and quantitative methods. Methods are used to examine the impact of virtual learning amongst the traditional and professional program students. This research work is completed through data collection in the form of questionnaire. The preliminary sources for open and closed ended questions were journals and research articles. This study taken into consideration the students from traditional and professional courses. Professional courses students are familiar with online learning mode but for traditional courses students it was new experience. The main concern was to assess whether online learning awareness affects the adaptability of leaners towards learning process. It is necessary to get more insight on learner's approach towards online learning. We have conducted an interactive session with the undergraduate

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and post graduate students of Changu Kana Thakur Arts Commerce Science College, New Panvel (Autonomous). It has added required parameters to be considered while learning online such as an availability of smart devices, internet connectivity. Through interactive sessions, it was observed that unstable internet connection was one of the main obstacles which leaners faced during the initial period of virtual learning. The questionnaire formed using google form consisted of fifteen questions regarding journey of online learning. The researchers collected 447 responses in total. Table I, shows the details of the data collected:

TABLE I

DETAIL OF RESPONDENT FROM TRADITIONAL AND PROFESSIONAL PROGRAMS

Faculty/ Program/ Course Name	Number of Students
Arts	128
Commerce	69
Computer Science	121
IT	08
BMS	29
BAF	56
Biotechnology	36
Total	447

Data collected includes learners' personal information along with area they belong to. Fig 1, depicts the pie chart of area-wise distribution of the learner.

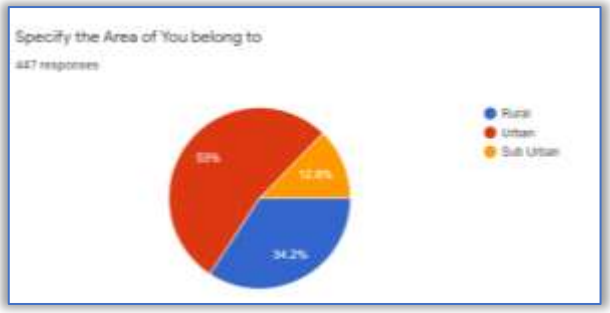

Fig. 1. Area-wise distribution of the learners'

RESULTS AND DISCUSSION

To examine the data collected using questionnaire a graphical representation is depicted using pie and bar chart. It has been observed that students from rural area faced problems during virtual learning. The prominent challenges faced by students during online learning are listed as below:

Digital illiteracy

Aavailability of Digital devices

Poor internet connectivity

Background noise

Poor Concentration

Fig 2, depicts that network issue and unstable internet connection are major areas of concern in online learning mode.

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Fig 2, Challenges faced by students during online learning

The above bar chart shows that 70% of students from rural and sub urban area faced network issue. From the interaction with students, it was clear that Electricity failure/Power cut off is main reason behind network issue. When students were asked about their virtual learning experienced, 72.2% responded they were happy with this learning mode. Approximately 55% of students wish to go for virtual learning in near future. This gives boost to National Education Policy, which Government of India in trying to implement for Higher Education [10]. Though whole learning process cannot be structured using virtual mode, but blended learning approach can be best suited to incorporate NEP in academics. This initiative can provide an opportunity for accessing academic programs anytime on the basis of flexibility of the learners.

Fig 3, Devices used by students during online learning

Last one and half year, as online learning take over the traditional chalk and talk teaching method, there are few changes in teaching and learning process. To check learners understanding level for a given topic, teacher used to assign quizzes to the student. Students used to physically attend different seminar and workshop to enhance their professional and communication skills. Online learning was able to provide all these facility through different digital tools and applications. These questions were included in questionnaire and findings are depicted in chart. Fig 3, shows that 84.6% of students are using smartphone to attend online lectures, workshop, quizzes and webinars. Physical separation of teacher and students raised questions about attentiveness and concentration of the students during online lecture. More than 80% of students believe that Face to Face communication with teacher during online lecture helps to understand concepts.

The next question after gaining information about attentiveness is: Whether the students are able to attend lectures smoothly or there are any disturbances? From the collected data it has been analysed that 92% of students have struggled in the initial period of online learning and now they are adjusted with it. From Fig. 4, it can be concluded that 81% of students understand the lesson taught by teacher through online mode. When students were asked about their favourite online application for learning, they have voted for MS Teams. In Changu Kana Thakur Arts Commerce and Science College New Panvel (Autonomous) MS Team is used for learning purpose. It shows that the students have demonstrated adaptability with digital tools which they regularly used.

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Fig 4, Understanding level of students during online learning

Online learning has advantages such as availability and disadvantages such as more screening time. Exposer to smart screen affects eye sight. Sitting at one position for longer period of time leads to spinal issues such as back pain and headache. Questionnaire tried to cover this point by enquiring students about the time spent for online learning.

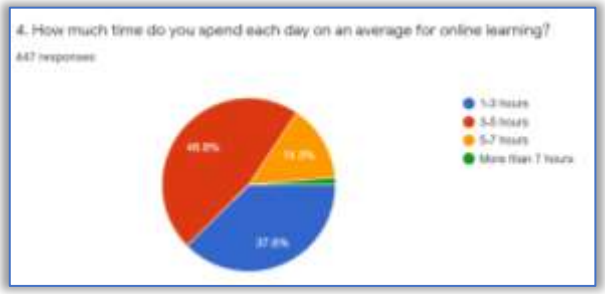

Fig 5, Each day time spend for online learning

Fig 5, shows that 84.4% of the students have spent maximum of five hours per day for virtual learning. No one can predict the future but everyone can become ready for pandemic situations. Learning is continuous process in students' academic journey and it should never stop because of Covid-19 like unprecedented situations. This questionnaire tried to find out students' preferable mode of learning.

Fig 6, Preferred mode for learning by students

Fig 6, shows that virtual learning is preferred by almost 54.8% of students. Making online learning compulsory is not good choice as many nearly 34.2% of students belong to rural area. But blended learning can come out as good alternative for education.

CONCLUSION

This section succinctly provides concluding remarks on nuances and repercussions along with suitable recommendation. Education is never ending and ever-changing phenomenon. Online learning gives flexibility to learning approach. Traditional learning requires classroom allocation and students' hourly engagement according to different faculty like Arts, Commerce and Science. On the contrary, online learning all teachers belonging to different faculty can simultaneously conduct lectures and students can focus other circular activities. Majority of the students are adapting themselves to virtual learning and enjoying online mode of learning. The New Education Policy initiated by Government of India has accorded special stature to online mode of teaching and learning in Higher Education [10]. Therefore, Blended learning could provide new horizons in

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teaching and learning in academics. In this way, an attempt has been made to identify various nuances and repercussions of virtual learning on the students of traditional and professional programs.

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Review on the Use of Expert System in Cognitive Development of Children

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ABSTRACT
The future of a country depends on child development, which includes various forms like biological, cognitive, language, social, emotional, speech, fine motor, and gross motor .These forms are essential for children's growth and development. Cognitive development is crucial for improving cognitive abilities such as thinking, listening, learning, understanding, and justifying questions. Nowadays, an expert system plays vital role in handling the psychological factors of human beings. Currently, available expert systems in the cognitive development domain are examined along with an assessment of their features and limitations. The expert system is capable of extracting current and future knowledge, estimating future outcomes, improving decision-making quality, and offering quick and robust solutions to complicated problems. This study has shown examples of expert systems with their computational decision-making systems also examine existing expert systems that are used to develop children's skills. The consequences of these systems on cognitive development should be examined in more inclusive studies.

Keywords: Cognitive development, Expert System, Decision-making, Skills, Knowledge.

1. INTRODUCTION

Children are the future assets of the nation. The progress of the nation depends on its grooming. Cognitive development is crucial for grooming children. Many Artificial Intelligence and data mining techniques are used to estimate the cognitive development of children.

Cognitive Development

Human beings collect, arrange, and use their knowledge through the process of cognitive development. The progress of cognitive conduct is the improvement of statistics, capacities, trouble-solving, and personality that provide help to kids to deliberate and understand the sector.

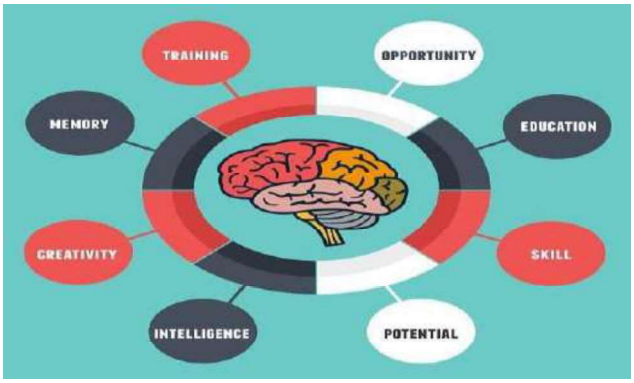

Figure 1: Cognitive Skills

Jean Piaget has explored four stages of cognitive development.

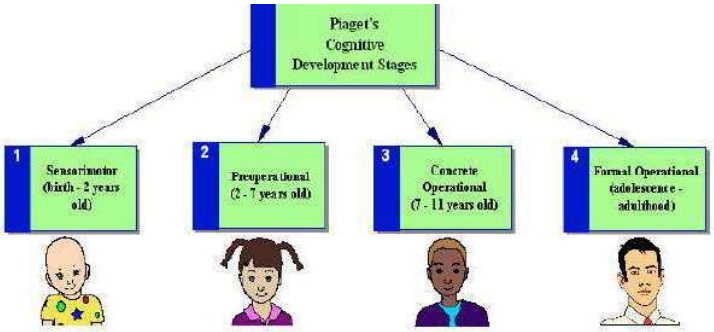

Figure 2: Piaget`s Cognitive Development Stages

Within the sensorimotor stage (up to 2 years) children can adopt the surroundings with their senses and in the preoperational level (2 years to 7 years) children can broaden their creativeness and reminiscence. Within the concrete operational level (7 years to 11 years) youngsters grow to be extra conscious of feelings, and in the formal operational phase (11 years and older) they use common sense to highlight problems or see areas. Many factors affected the cognitive improvement of kids like organic, environmental, gender, enjoyment, and circle of relatives. Children's mental degree can be assessed by assigning a stage to each mental factor. Nowadays, the psychological elements of human beings are dealt with greater efficiently by means of expert systems. It simulates the conduct of human specialists and assesses the psychological factors of the kid consisting of intelligence, reminiscence, concentration degree, and so on. The cognitive development area has benefited from massive methods together with records, class, and prediction for studying numerous dimensions of cognitive development.

EXPERT SYSTEM:

Expert systems are a popular branch of artificial intelligence that has numerous applications across multiple domains. Expert systems are interactive computer programs that contain the experience, knowledge, and skills of an expert or group of experts to solve the problem [10]. Expert systems fall into five basic categories: rule-based, frame-based, fuzzy, neural, and neuro-fuzzy.

Following are the components of the Expert System:

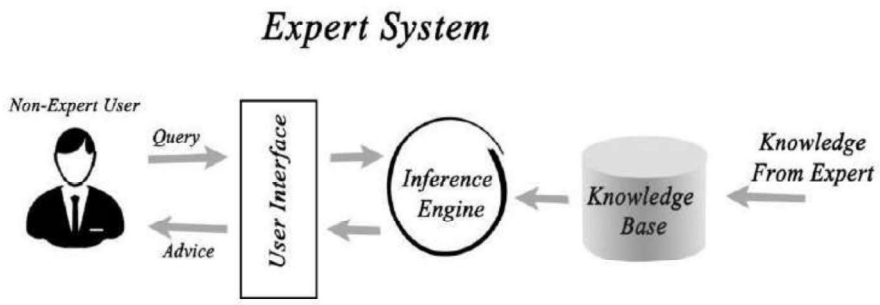

Figure 3: Components of expert system

1. **Knowledge base:** The knowledge base in the expert system represents facts and rules. The knowledge base obtained from the human expert is prepared by a knowledge engineer [23].
2. **Inference engine:** An inference engine is used to extract significant information from the knowledge base, translate it, and discover solutions to the user's problem.
3. **User interface:** This component is important for making the interaction between user and expert system and finding the right solutions.

This study explores expert system applications in the cognitive development of children, such as detection of intelligence, addiction, and prediction of disease. It also provides suggestions or guidelines based on obtained results.

2. LITERATURE REVIEW

Various psychological development research had been implemented the usage of distinct statistical and computational techniques which includes Statistical package for the Social Sciences, Crypt-arithmetic, Fuzzy methods, and classification and prediction algorithms.

A cognitive model plays a critical role in psychological development. This may be evolved the usage of special techniques. A Java-based expert system became shaped to determine a kid's intelligence and expect their career possibilities [4]. Crypt arithmetic techniques have been used to find mental components such as intelligence, problem-solving, and endurance [27]. The certainty factor approach is regularly balanced with minimal cost in expert systems. This technique was used to calculate a child's intelligence [29] and also used to expect an early prognosis of personality disorder based on its signs [5]. The SL5 object language specifies the use of professional structure regulation-based logic. Such expert systems have been used to diagnose depression levels and provide counseling based on them. [9] The system was also used to detect nausea and vomiting in children [23]. A similar study [24] used this expert system to detect health problems related to video game addiction. Statistical Package for the Social Sciences (SPSS) is basically used for analysis. Using this method, anxiety and depression were analysed with an accuracy of 75% and 55%, respectively [26]. Weighted product is a multi-

criteria decision making technique. This method was used to determine the best way to diagnose a baby's illness, which revealed a number of illnesses in infants [18]. The fuzzy expert system is an artificial intelligence system that uses a collection of membership functions and rules. This system was used to detect the affective and cognitive status of Maths subjects from individual learners [7]. A similar study [17] obtained types of child intelligence using the fuzzy method. Various data mining and AI techniques such as classification, regression, clustering, and prediction were used to evaluate psychological progress. In study [3] various algorithm of data mining were used to classify and predict children's progress [3]. Fuzzy clustering is used for cluster analysis and this approach was used to expect learning disabilities in children [15]. Forward chaining and uncertainty factor methods were used to stumble on signs of game addiction along with excessive, common, and low [20] and were extensively utilized to decide the traits of youngsters with special desires [22]. The decision tree, forward and backward chaining technique became used to diagnose memory loss diseases like Alzheimer's, Parkinson's, Huntington's, and dementia, and suggested treatments for them [14]. A similar study [21] was used to predict children's mental retardation. Naive Bayes, Neural community, J48, SMO, and RBF algorithms were used to achieve attention deficit and hyperactivity disorder in adolescence [8]. A neural network was used to develop a model to assist teachers in detecting mathematically gifted pupils in elementary schools. [16]. ANN and regression techniques were used to generate remedy plans for human beings with speech-language issues, handling clinical data, and cognitive improvement statistics [28]. Principal Component Analysis and correlation-based algorithms have been used to anticipate disability learning [11]. Agent and heuristic-based algorithms were used to diagnose and compare the gaining knowledge of disabilities of unique needs students [12]. Bayes theorem turned into used for predicting the net dependency degree of youngsters [19]. A study [25] was used to predict human behavior on social media using CLIPS. Autism Diagnosis and Advisory Expert System was developed to offer parents an initial diagnosis of Autism Spectrum Disorder (ASD)[2]. Visual basic .Net language was used to diagnose ear problems in children and provides advice based on obtained results [13]. Web based expert systems were applied to diagnose baby improvement and examine preschool kids' language [1][6]. In a study [10] learning disabilities were determined by considering psychomotor aspects like intellectual, perceptual, language, and personal.

3. APPLICATION AREA

This research is focuses on cognitive development. It is essential for parents to develop cognitive skills to identify causes and effects, as well as to develop analytical skills. Specialist systems can be used to assess a child's mental abilities and these assessments can be used to diagnose child psychological problems and provide recommendations for dealing with the child. This study can also have a positive impact on society by creating expert system models that are used to mimic human psychological processes and provide useful information to a person. In addition, this study may lead to the development of a professional program that is used to manage child addiction or other related disorders.

4. CONCLUSION

The expert system is a computational technology that solves complex problems using task-specific information and inference, similar to the skills of human specialists. The performance of traditional methods has been significantly surpassed by expert systems. This study examines the applications of expert systems in child mental development over the past two decades, highlighting the importance of expert systems in child cognitive development. According to the reviewed research, psychological factors can be assessed using expert systems and various methods. Furthermore, in order to overcome the limitations of different approaches, an integrated expert system must be built based on different approaches. For an accurate result, more research or progress is needed. Expert systems form rule-based systems to improve children's cognitive abilities. This can be achieved by identifying those problems and finding solutions using expert systems. This system is beneficial for parents to manage the mental disorders of the child.

5. FUTURE SCOPE

Cognitive skills are important for a child's development because they affect learning and performance. Weak cognitive skills are an unusual reason for knowing difficulties. Various strategies to improve children's skills or solve their problems have been validated in the past. However, development requires improvement in decision-making ability, interest, processing speed, visual processing, auditory processing, recall, and many other skills. Future work can take advantage of computational strategies to implement all capabilities simultaneously. Various factors related to child development including cognitive, linguistic, social, emotional, speech, fine motor, and gross motor can be enhanced with the help of special structures. In the future, the Expert System may support a variety of packages that allow for new insights and progress of change.

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Expert System for Sanskrit Grammar

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1. ABSTRACT
Today the computation tool provides an easy platform for learning difficult languages like Sanskrit effectively. This learning can be very helpful to students. An expert program is a comprehensive computer intelligence tool that tries to solve a problem. It has been gaining traction over the past decades because of the better integration sites available on personal computers. The goal of the study is to introduce an expert system that can find solutions to students' problems regarding translation, Sandhi classification, and interpreting images with Sanskrit alphabet sets. In this study, a Python-based expert system was designed and implemented.

Keywords: Expert system, Python, Sanskrit language, Translation, Sandhi

2. INTRODUCTION
Sanskrit language is the composition of religious texts like the Mahabharata and the Ramayana. Many modern-day languages like English, Spanish, and Japanese, have accomplished greater positions in education but in this modern age Currently, Sanskrit is being regarded as a pure grammar and scientific language. Sanskrit is deeply rooted in our culture, and it is internationally acknowledged. This language gained a lot of popularity because of its philosophical features and influenced many Indian and Southeast Asian languages. In comparison with other languages, Sanskrit has the largest vocabulary and is able to convey the most meaning in the fewest words. To study this language, one requires calmness of mind, patience and devotion for the language. However, expert systems are now developing as prevailing instruments in piloting a new period of universal revolution in modern education for all types of progress in the society. The right tool to preserve and promote traditional Sanskrit studies is expert systems. Many schools adopted Sanskrit as an elective subject. AS well new education policies adopted Sanskrit language as compulsory subject in primary schools. While learning this language, learners get some difficulties like transliteration, Sandhi splitting etc. The study presents expert system that provides solutions for learners.

3. LITERATURE REVIEW
A previous study focused on Sanskrit grammar like machine-based transliteration, Sandhi Splitting, analysis of various language transliterations etc. These methods were described by various computational techniques. To translate any language into another, a transliteration tool is used. This tool was applied to translate the Sanskrit into Hindi language with the help of a rule-based approach. [9] Also same approach was applied to translate text with English and Sanskrit pair using speech recognition techniques [3]. This study [5] reported comparative study analysis on different translation services; rule-based, corpus-based, and direct for ML. Various Indian ML methodologies have been studied for Sanskrit languages [2]. The Corpus-based translation system was applied to translate Sanskrit and Hindi pair. [8]. Grammar terms in both English and Sanskrit, like nouns and verbs, were used. The whole structure for Rule-based translation and Example-based translation was described in detail for source and target language pair. [12] A Sandhi is a technique by which two or more words are joined together. Sandhi viccheda means splitting words or sentences into its constituents. Using these techniques, the Bhagwat Geeta was split into words [1]. An algorithm based on panini's complex codifications rules was used for sandhi formation using morphological analysis [11]. Rule based algorithm was used to sandhi viccheda for Hindi compound words [10]. Object detection was classified objects and behaviours. All object detection techniques were categorized on based on shape, texture and motion.[13]. The applications of object detection have been summarized [14].

4. OBJECTIVES
- Transliteration of English word to Sanskrit word
- Sandhi Splitting
- Describe image in Sanskrit language.

5. DESIGN, IMPLEMENTATION AND RESULTS

4.1 DESIGN
A computerized expert system simulates the capability of humanoid experts to make decisions. Expert systems are designed to solve complex problems by reasoning based on a set of knowledge that is primarily expressed as rules rather than traditional procedural codes.

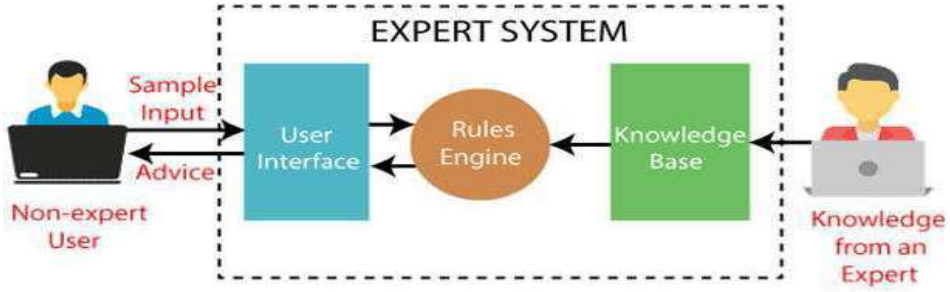

Fig. 1: Component of expert system

1. **User interface:** Non expert users need this to learn how the expert system works and easily identify resolutions. Python language was used for this study to develop User interface.

2. **Inference Engine:** Inference engine tries to match the condition (IF) part of each rule in knowledge base with facts currently available in the working memory.

3. **Knowledge base:** The knowledge base in an expert system represents facts and rules. It contains knowledge in specific domains along with rules 5 in order to resolve problems, and form procedures that are relevant to the domain.

4.2 METHODS OF DATA COLLECTION

This study opted questionnaire method based on qualitative questions to get learners' difficulties. 10 In this study 150 learner's data were collected from different high schools of New Mumbai. This questionnaire consists of following questions:

- Do you like Sanskrit languages?
- Why have you selected Sanskrit language?
- Do you need subject teacher or any special instructor to solve your Sanskrit language queries?
- Can you easily describe the given picture in Sanskrit Language?(if no then specify your difficulties)
- Can you easily translate Sanskrit word/sentences into other language? (If no then specify your difficulties)
- Can you easily identify singular or plural word? (If no then specify your difficulties)
- Can you easily make the word from Splitting letters 11 and vice versa? (If no then specify your difficulties)

4.3 DATA ANALYSIS

In this survey, most children had difficulties with translation, Sandhi Splitting, and Image description 9 in Sanskrit language. These difficulties were evaluated using Chi-Square hypothesis analysis.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The categories defined by Doyoulike Sanskrit languages = 1.000 and 0.000 occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	.000	Reject the null hypothesis.
2	The categories defined by Doyouneedsubjectteacheroranyspecialinstructortosolvey = 0.000 and 1.000 occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	.001	Reject the null hypothesis.
3	The categories defined by Canyoueasilydescribethegivenpictureinsanskrit Language = 1.000 and 0.000 occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	.462	Retain the null hypothesis.
4	The categories defined by Canyoueasilytranslate Sanskritwordsentencesintootherlang = 0.000 and 1.000 occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	.462	Retain the null hypothesis.
5	The categories defined by Canyoueasilyidentifysingularorplural wordifnothenspe = 0.000 and 1.000 occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	.289	Retain the null hypothesis.
6	The categories defined by Canyoueasilymaketheswordfrom Splittingletersandvicever = 0.000 and 1.000 occur with probabilities 0.5 and 0.5.	One-Sample Binomial Test	.083	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Fig. 2: Hypothesis Test Summary

A one-sample binomial test 1 was used to test hypotheses based on Sanskrit language difficulties and school factors. From the above summary table, 7 it can be seen that learners from different schools faced different difficulties like translation, finding the singular or plural word, image description, and Sandhi splitting. Expert system has developed after identifying the difficulties learners encounter with Sanskrit grammar.

4.4 Proposed Expert System

A Sanskrit grammar expert system developed by data analysis. Python programming is used for developing Expert System that having various advanced libraries and modules. This expert system consists of three modules:

- **Translation of English word into Sanskrit Word**

A script written in one language is converted into another is called as translation. In proposed work, this tool was developed to transliterate English into Sanskrit word. A dataset was designed that included English words along with their Sanskrit meanings. Following diagram shows working of transliteration.

Fig. 3: Transliteration model

The expected outcome of translation from English to Sanskrit is as follows:

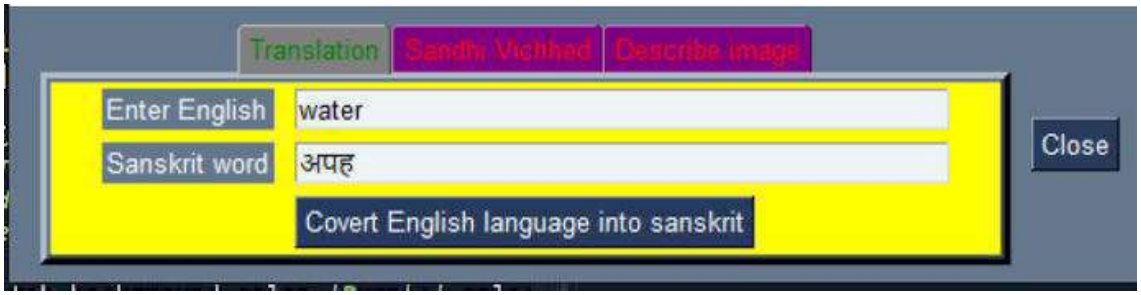

Fig. 4: Translation of English word into Sanskrit Word

- **Sandhi Splitting**

Sanskrit_parser is a Python module that supports three different uses of Sanskrit like morphological analysis of the word, word splitting, and syntactic analysis of the sentence.

Sanskrit_parser is a python module that analyses Sanskrit grammar in three different ways: morphologically, by splitting words and by analyzing syntactically. Sanskrit_parser module also splits the word. The expected outcome of Sandhi Splitting is as follows:

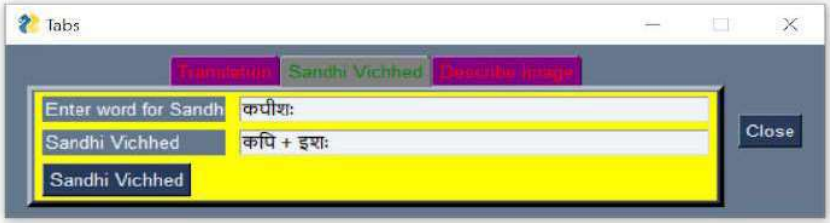

Fig. 5: Sandhi Splitting

- **Describe image in Sanskrit language.**

This module was developed using the OpenCV library of python. Using an input image, the objdetect module of OpenCV used to detect the object and caption it in English. The expected outcome of detecting object is as follows:

Fig. 5: Detecting objects

Using caption and result image, formed a small sentence in English and translated it to Sanskrit

6. CONCLUSION

The expert systems are increasingly used and seen as a powerful tool for solution of complex problems. Sanskrit grammar, one of the hardest aspects of the language, was addressed in this expert system using Python. This expert system was capable to translate English word into Sanskrit text, Sandhi splitting and identify objects of image and translate it in Sanskrit. Future work will include morphological analysis as well as translation of large sentence English into Sanskrit.

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