FTRSAA-Design and Development of Robots for Health Services

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ABSTRACT
In this proposal, human-assisted robots for medical applications was discussed. Voice recognition, object recognition, capture, vision Selection, and sorting can be done by helpful robots Fuzzy Temporal Rule-based Semantic Analysis algorithm (FTRSAA) and intelligence thought. The image processing and machine learning techniques using a vision camera can be applied in assistive robot programming for the voice and object recognition, graphing, and tracking of objects have been performed by machine learning techniques. The algorithms suggested for grabbing objects, such as image segmentation, RoI extraction, and classification,are thus explained. Machine vision connected to gripping three things has been explored.

INTRODUCTION

This proposaldiscusses the useofrobots inhealthcare systems to help adults, witha focus on developing robotic applications using intelligence machine learning skills and techniques.The search has a selection of features, categorization, and decision-making based on reason.Robotscan be classified industrial or non- industrial, and in the form of non- industrial, they can be further classified as assistive (human service, robot companion, etc.) or non assistive.

The use of robots presents an opportunity to improve the quality of care provided to older adults. However, the applications created must be tailored to meet the specific needs of this demographic, which can be a challenge. More sophisticated techniques are needed to create acceptable technology. One of the most innovative areas of computer science is computer vision, with applications such as real-time video surveillance, robotic navigation, and ranging. Some researchers have proposed real-time pose estimation to provide a more accurate solution. In this proposal, we will propose a new mobility support robot system that allows elderly people to live longer and safer at home.

LITERATURESURVEY

Machine Learning is for performing complex tasks.Object grasping, in particular, is a natural human intuition that is difficult for robot operators to manage. Machine learning (ML) algorithms are necessary to address such challenges. However, the use of ML techniques in robotics applications is still challenging, particularly for novel challenges. Several years of research have been dedicated to developing systems, algorithms, and modules that can recognise images. Neural networks are used to teach computers how to construct an array of numbers. Inverse kinematics problems in robotics are addressed using neural networks. For deep data analysis, convolutional neural networks (CNNs) are the most frequently used algorithms in computer vision. In addition to handling all dataset formats, including robot angles, CNNs can recognise contributed features more accurately than other feature

selection methods.
CNN is a popular deep learning architecture that consists of three layers: the convolution layer, the pooling layer, and the fullyconnected layer. It canquicklyand accuratelyclassify input imageswithfewerpre-determinedfeatures,makingitCNN'spoolinglayerreducesthefeature
map's dimensions to speed up processing. Deep learning techniques use unsupervised feature learning methods to train neural networks and prevent overfitting, leading to exceptional performance in various fields such as computer vision, natural language processing, and audio processing. Complex robotic problems like grasping unexpected objects, avoiding obstacles, and cutting unknown food ingredients are solved using deep or neural network methods. The support vector machine algorithm is crucial in supervised learning techniques, and learning algorithms have applications in both academic and commercial settings, including facial recognition, text classification, credit card fraud detection, and medical diagnosis. The k-Nearest Neighbor (kNN) method and Decision Tree (DT) algorithm are two machine vision learning techniques that are used to improve accuracy and speed up convergenceeffective in feature analysis andclassification. The full convolutional architecture of CNN involves multiple filters that generate feature maps from the input features.
The DT algorithm is often utilized for inductive inference, where it separates objects by estimating relevant features that represent multiple classes to achieve high accuracy. By examining the closest match of the test data in the feature space, it trains the data to different classes. The Naive Bayes classifier can be combined with feature selection techniques, while the "random forest" classification system employs a set of randomly chosen forest trees from attributes, enabling it to handle large amountsofqualitative and quantitative data while analyzing the biological diversity of the data.
Deep learning algorithms employ a large-scale, hierarchical neural network that provides greater efficiency through strong connections. These algorithms outperform conventionalmachine learningalgorithms, offering highaccuracyand significant predictability, and areused in numerous applications such as speech recognition and image processing. Many researchers in AI, ML, and image processing have studied the Genetic Algorithm (GA). Machine learning (ML) refers to the process of learning how to predict an unknown function from a limited number of examples. Traditional statistics focuses on hypothesis testing and density estimates. When statisticaltechniques are employed in machine learning, theycreate computer programs that learn to create an intelligent system.

ImagePre-Processing

Real-time augmented reality systems require multiple tasks to be performed, such as capturing images frominput sensors, processing them, and providing appropriate responsesto the user. Advances in memory and processing speed in computers have enabled researchers toexplore the fields of robotics, computer vision, and image processing. "Feature weighing" is the practice of assigning weights of either 0 or 1 to each feature. A mathematical model is used to divide the dataset's features into appropriate and non-appropriate characteristics. However, the number of features provided, even with benchmark datasets, can be overwhelming, lengthening the time it takes to classify data. Many features obtained during feature extraction are insignificant, or they have a minor impact on decision-making. To address this, additionalfeatures are added after classifying the initial batch of data. A new feature selection algorithm, Fuzzy Rules and Information Gain Ratio-based Feature Selection Method (FIGRFSA), based on fuzzy neural network concepts, is proposed in this proposal. Various optimization methods, including evolutionary algorithms, rule optimization methods, and linear programming models, are available in the literature for feature reduction. An intelligent agent-based optimal and incremental feature selection algorithm (IAOIFSA) is proposed to improve decision accuracy by classifying the visuals captured from the robot execution environment. Defuzzification is the processofconverting a fuzzyoutput froma fuzzyinference systeminto acrisp output(Rameshet al., 2022).

ImageClassification

Techniques Image categorization is a major area of interest for many researchers. A classifier is a type of machine learning model that consists of two phases: training and testing. During the training phase, a set of labelled examples is used to establish rules based on the properties of the dataset. Classification problems are broadly categorized into supervised and unsupervised challenges. In supervised classification, labels are assigned based on one or more characteristics ofthe data. A new supervised machine learning-based approach, called FIGRFSA, has been proposed for efficient feature selection. In image categorization, the task of assigningone or more labels to an image depends on its contents. This is a common supervised learning problem, where training is performed ona setoflabelled images. The objective ofthis research is to explore classifiers and utilize themto predict the labels ofnew images. This research, which is focused on image classification, lies within the realms of computer vision and machine learning. The typical large-scale image classification pipelines incorporate linear classifiers and high- dimensional image descriptors. The fuzzy rule-based neuro-genetic classification algorithm (FRNGCA) is proposed for image classification to address the ranking problem. Furthermore, a deep learning system known as the Neuro-Genetic Fuzzy Temporal Rule-based Classification Algorithm is introduced.

AssistiveRobots

Robot research and its use in healthcare services have gained significant attention in countries such as Japan, the US, Germany, Italy, and Spain. Remote operation, made possible by tele-robotics, is the most common method of controlling robots. In the 1940s, remote-control teleoperation robots were first developed for handling nuclear radiation. In the 1980s, RastogiAnu and colleagues explored how stereo vision could assist inexperienced operators in common defence-related telerobotic activities. Researchers have since conducted numerous studies on assistive telerobots for the elderly, utilizing feature selection and classification methods for efficient data classification. To improve user interaction, a natural language interface can be incorporated (Augello et al., 2022; Song et al., 2022). Recent advancements in the Internet of Things (IoT) have enabled people to access intelligent devices, services, and opportunities. These intelligent IoT devices have the potential to assist elderly and disabled individuals, giving them access to smart infrastructure. In response to these needs, nursing care service robots are being developed with intelligent and smart capabilities that are controlled by machine learning (ML)and artificial intelligence (AI) methods. Sociallyadaptive robots are designed to assist those with physical limitations who require physical interaction. They can be categorized into two groups: companionrobotsand service robots. Companionrobotsprovide companyfor elderly individuals, while service robots assist with daily tasks such as eating, showering, and monitoring. Examples of socially supportive service robots include Florence, RIBA, and Flo, which have demonstrated superior performance compared to other existing systems. Furthermore, demographic and empirical research studies offer the elderly population the opportunity to hear from experts in various fields (Feng et al., 2022; Wang et al., 2022). The objective of social science and anthropology research is to utilize supportive robots to improve elderly engagement and provide themwithincreasedassistance.Theemphasisintechnologydiscussionsfrequentlyneglectsto foster greater connection and instead focuses on the elderly's needs, according to their observations. The You Only Look Once (YOLO) v2 system, which includes a robotic arm manipulator and camera, was developed using CNN. To automatically execute the intended task, an automatic closed-feedback method employs target position data to direct the end-effector. Isabel Pedersen et al. (2018) conducted a review and analysis of social robots, focusing on contemporaryacademic resources. Theyhave devised a modest method for determining armerror position to account for inaccuracies introduced by inverse kinematics estimation. User attention demographics are a critical consideration in the provision of health care robots. As the number of elderly and adult individuals grows, critically equipped robots are being created with thenecessary hardware and software requirements to meet their needs. Telemedicine is thetechnology used to collect and transmit user data about these healthcare robots to a network of healthcare providers. A new service robot software architecture was created to provide manipulator services in a human setting.

NaturalLanguageProcessing

In the development of robotic systems, Hidden Markov Models (HMM) are frequently used to accurately match spoken words. Through human speech, the robot can extract the necessary feature information for speaker identification. Once the user's information is extracted, the robot can perform tasks such as user tracking, emotion analysis, and dialogue management. Robotic assistance devices are used by individuals with spinal cord injuries, cerebral palsy, and the elderly. Robotic support arms have increased users' independence. Recurrent neuralnetworks and rule-based expert systems can be combined to create a mapping range (RNN). Previous researchers have developed Kinova-Jaco2 robot systems for the benefit of society. Users of assistive robotic arms, especially elderly individuals, need to be able to manipulate and handle objects. The remaining motor functions of the Jaco2 robot are linked to a joystick (Semeraro etal., 2023). Assistive robots are equipped with voice command capabilities, allowing them to communicate effectively with individuals who have physical disabilities. These voice commands can be given either through spoken orders or augmented reality 3-D glasses. CMU Pocketsphinx and GStreamer are two programs that employ voice commands, along with an automated voice recognition system that receives pre-processed speech input. By combining the rules of recurrent neural networks(RNNs) withthoseofrule-based expert systems, a mapping rangecanbecreated, which uses context-free grammars to recognize RNN functions. In a study using the middleware foundation of the Robot Operating System (ROS), researchers focused on using voice control for robot arm control, creating a helpful tool for patients in care rooms. The system was developed using open-source software platforms and utilizes the Python speech recognition API and Pocket Sphinx to translate the operator's speech commands into text form (Ramesh et al., 2022).

ASSISTIVEROBOTS

India is expected to have a senior population of 173 million bythe year 2026, with nearly 104 million individuals aged 60 or older. Of this population, 51 million aremen and 53 million are women. Elderly individuals in India are facing significant health challenges, including cognitive decline, and are seeking high-quality services that enable them to live independentlyand be with their families. In the United States alone, around 150,000 people rely on robots that provide support for activities of daily living (ADL). Many countries around the world are exploring the potential of social, dedicated, and helpful mobile robots to act as caregivers and companionsfortheelderly.Robotsarealsobeingutilizedinthehealthcareindustrytoperform time-consuming and repetitive procedures such as telesurgery (Augello et al., 2022). The increasing number ofelderly individuals has led to the development ofassistive robot devices for home services. These robots can function either fully or partially autonomously. While there are severalassistive robots available to aid individuals withphysicallimitations, theymaynot always be able to adapt to unpredictable or dynamic environments.

Telerobotic:KinovaJaco2 Robot

Robotic armsthat receive commandsand interactwiththeir environment arereferredto as "slaves," while the device used to controlthemisknownasthe Human-Machine Interface (HMI). Tele-robots are a type of robot that can be operated in real-time from a distance using rules and heuristics. These robots receive visual feedback from cameras and displays. Tele-robotic devices can be used to provide specialized treatment to geriatric patients in remote locations.However, thetime delayinthese systems canresult in lower communicationchannelperformance (Pachidis et al., 2020). The Kinova Jaco2 robotic arm consists of a basic body with six degrees of freedom and a gripper with three degrees of freedom. It can be controlled by voice or vision with six degrees of freedom. The robot was designed and installed for individuals who use electric wheelchairs and have limited upper-body mobility. The robot's end effector can automatically calculate the required forces and torques for each actuator, enabling increased autonomy in tasks such as eating, drinking, object manipulation, and opening/closing doors (Campeau-Lecours etal., 2019).

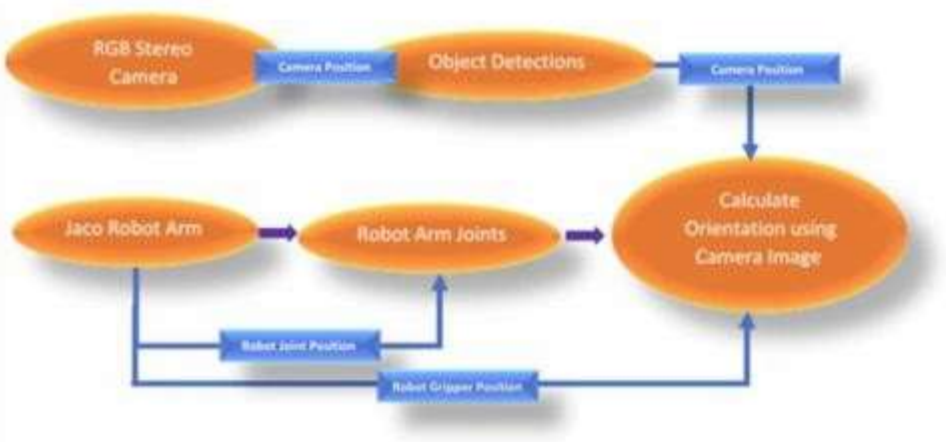

Figure1.Schematicofassistiverobot

The robot gripper can be activated automatically by utilizing inverse kinematics to determine the object's position and pose based on the user's command. Figure 1 shows the flowchart that directs the movement of the assistive robot arm. The robot arm's orientation is determinedbyvideo frames,and feedbackonthegripperpositionisusedtoadjusttherobot arm's movement and joints. The geriatric individual using the robotic system must issue commands to the robot.

Need forNaturalLanguage Processing

Human-robot interaction (HRI) is a challenging and significant topic in robotics and artificial intelligence (AI). Object recognition systems based on speech and vision can create contactless interfaces. Remote interaction is a significant benefit of this method, especially for elderlyindividualswhomayhavedifficultywithdirectphysicaltouch.Speechrecognition technology has made significant advancements in recent years, revolutionizing human-robot communication. Modern approaches such as hidden Markov models (HMM), artificial neural networks (ANN), and neural networks can enable communication with intelligent robots. Neurolinguistic programming (NLP) is a critical contribution of AI, utilizing several processing steps to help computers understand human language. In robot control, NLP is particularly useful when using voice recognition to operate the robot. Natural language processing (NLP) has long been a desired goal and is considered one of the most critical technologies for medical robot design. In dynamic contexts such as controlling a robot arm, NLP can be used to solve the complex task ofoperating the robot based on the instructions ofan elderly individual(Pulikottilet al., 2018). The use of voice control systems allows elderly individuals to manage tasks that involve high DOF functions. The first step involves reducing the dimensionality of the user's speech signals based on prior knowledge and extracting the relevant features. One of the biggest challenges in Natural Language Understanding (NLU) is extracting the meaning of a sentence. Gaussian Mixture Models (GMM) have been used to extract features from speech data. Each frame of the time domain is converted to its corresponding frequency domain using FFTs.Spectral subtraction, wavelet transform, principal component analysis (PCA), and cepstralanalysis are among the methods used. In order to stem a word, its base or root word must be identified in its written form. The Porter stemming algorithm developed by Porter MF (1980) is the most commonlyused algorithminEnglish. Byidentifying the verb, one canfillina varietyof verb templates with the sentence roles of the participant. For robot arm control, neural modeling and deep learning techniques are employed. Conceptual dependency was first developed to symbolically represent knowledge extracted from input in plain language. The concept of Convolutional Neural Networks (CNN) was first introduced in 1994, leading to significant advancements in deep learning. For efficient processing, unprocessed speech is directly fed into CNN-based acoustic models, which can translate auditory characteristics into spoken phonemes. The feature learning step of this model employs convolutional layers, while the classificationstage is used for phoneme classification (Pulikottil et al., 2018).

StereoVisionSystem

Stereo vision involves using two cameras to capture images of a scene and determiningthe depth perception of objects in the scene. This is achieved by extracting 3-D information from the images obtained fromthe two cameras. Tracking an object within the camera's field of vision is critical, and this can be accomplished using stereo vision. However, estimating an object's position and orientation is a challenging task that requires camera calibration and a frame coordinate transformation between the stereo camera and robotic arm. Feedback control mechanisms based on image processing are used to control robots with stereo vision. Two typesof camera tracking modules are available: moving camera tracking and fixed or stationarycamera-based tracking. Cameras that can pan, tilt, or move while keeping their field of view can track an object more effectively. Self-motion alignment is used to create precise item size and shape, allowing for more precise robot control. The Robot Operating System(ROS) package was used to create a video capture (streaming) model, and the ROS melodic distribution was used for the trials. The radial distortion approach was used as the calibration technique in this case. To obtain the 3-D position with stereo vision, comparable points in each image must be identified (Moolchandani et al., 2022).

ObjectGrasping

TheJaco2 robot detectsand recordsavirtualscene ofanobject using itsdepthsensor.The grasping system utilizes segments from a segmentation algorithm to control and execute the robot's gripping motion. This study proposes using image processing and deep learning to detect the robot's stance and grip on an object. The research separates geometric-based and appearance- based models for item detection into two categories. AI and ML algorithms play a crucial role in the field of robotics. Developing an autonomous grasping robot to assist humans is a challenging task. The study considers twelve objects, such as a blue water bottle, tumbler, spoon, tablets,black key, syringe, kit box, plate, small water bottle, AC remote, and scissors for grasping using deep learning and machine learning techniques. Deep learning achieves the most effective grasp configurationandobject localization. Temporallogic is beneficialforanalyzingpreviousdataand predicting future outcomes using past and present data. A Convolutional Neural Network (CNN) is employed, and fuzzy temporal rules can be used with evolutionary algorithms to optimize feature selection and reduce classification time while improving classification accuracy. Fuzzy and temporal logic collaborate to generate inference rules that support explanation- and analogy- based thinking (Song et al., 2022).

FuzzyRules

A novel approach to feature selection known as Fuzzy Rules and Information has been introduced, which is used to select the optimalnumber offeatures for a classificationsystem. The algorithmcalculatesthe informationgain values for each featurefromtheset offeaturesextracted from input images. Fuzzy temporal constraints are then applied to determine the suitability ofeach feature for inclusion in the selection process. Genetic algorithms are utilized to identify the optimal number of features. Byreducing the number of features, the classification process can be expedited while improving classification accuracy.

IntelligentBased Algorithm

Thisapproachinvolvesbreakingdowna video sequence into individualframesto enhance categorization speed and classification accuracy. Intelligent agents are utilized to sense the environment, establish rules, and determine the optimal number of features from the available features. After extracting crucial frames from a dataset, boundary analysis is performed using spatial constraints. The information gain ratio is then computed based on frequency values and spatial and temporal constraints (Feng et al., 2022).

FuzzyNeuro-GeneticAlgorithm

To enhance the accuracy of image classification for guiding robot arms in providing medical assistance to elderly patients, a new classification technique has been proposed. The technique combines fuzzy rules and genetic algorithms (GAs). A novel fuzzy rule-based neuro- genetic classifier is created using a functionthat calculates the weighted average ofthe number of 1s and 0s. The neural network consists of an input layer with 10 nodes, two hidden layers, a sigmoidal activation function, and a bias function. Fuzzy rules are suggested for weight modification, and a bias value is added to improve classification accuracy. Finally, the best classificationisselectedusinggeneticalgorithms.Thecombinationofthisadvancedclassifierandfeatureselectionprovidesapowerfuldecision-makingmethodformorepreciseitem recognition.

Neuro-GeneticFuzzyTemporalRuleAlgorithm

The Neuro-Genetic Fuzzy Temporal Rule-based Deep Learning Classification Algorithm (NGFTRCA) is proposed to improve the accuracy of image classification. It enhances convolutionalneuralnetworkswithautomatic feature extractionand featureselectioncapabilities. The NGTTRCA also provides the deep neural networks with fuzzy temporal rules and selected features. The convolutional neural network is constructed with ten convolutional layers andeleven max-pooling layers to efficiently classify the dataset. The proposed algorithm offers significant improvements in classification accuracy and a reduction in error rates.

ObjectGrasping Algorithms

The pre-processing algorithm for images involves noise reduction and data normalization usingthe min-maxnormalizationmethod. Afuzzyspatiotemporalrule-basedconvolutionalneural network algorithm has been proposed for object classification. The classification algorithm employs geographical, temporal, and fuzzyprinciples to accurately identify the location and time of object pick and to handle ambiguity. Automatic feature extraction and feature reduction are performed using a deep learning system, CNN. The objective ofthis research is to understand the functioning of robotic grippers by developing an algorithm that provides the necessary rules for actuating the gripper to the target position and achieving more precise object grasping. Twelve different objects, including a water bottle, a tumbler, and a spoon, were experimented with using the Kinova Jaco robot to evaluate its grasping performance.

ROBOTICSANDCOMPUTERVISION

Augmented Reality

NASA was the first to integrate augmented reality into teleoperation, allowing for scene annotation, position stabilization, and tracking range control. Augmented displays have been shown to be beneficial to users in robotics and telerobotics, particularly in unprepared environments where natural features can be tracked. Researchers have proposed a novel see- through approach to 3-D object tracking that combines database handling methods, allowing for improved object tracking. Computer vision-based robotics also employ 2-dimensional images to predict the robot's next move (Costa et al., 2022). Augmented reality is used by robots' vision recognition systems, with a 3D rendering engine being employed. Novel methods for creating augmented reality environments, including a new model called the "heuristic mathematical model," were developed. The model reduces the robot end effector by using a method that minimises it. This approach improves manufacturing unit time and increases the total number of units whendeveloping robot cells. Time optimisationtechniques were employed to determine the optimal job sequence. The technique converts data into text files, which are then transmitted tothe robot arm. This strategy is effective in controlling ambiguous real-world scenarios. Soft computingwasemployed inthe implementation, withevaluationparameters,tools,databases,and sounds used for the final touches (Tovar et al., 2022).(Tovar et al., 2022).

StereoVision System

The human-machine interface plays a critical role in telerobotic display, allowing for communication with the telerobots. Computer systems mimic biological stereo vision systems by studying published research. Initially, it was proposed to reconstruct a scene using a computer program, which led to the resolution of the correspondence problem for scene reconstruction in computer vision. Computational stereopsis fields and stereo vision topics were the main focus of the final section ofthe presentation. The stereo vision systemuses a method to calculate disparity by combining the scene depth map and image registration framework, which allows for the manipulation of any physically accessible 3-D space via stereo vision. The robot's posture estimation problem is based on key elements from the photographed scene and geometric constraints. A robust depth segmentation and object classification approach are used to evaluate the scene based on the estimated robot stance. However, the theoretical elements of closed loop image processing have limitations when applied to visual tasks like object detection and classification (DeChant & Bauer, 2022; Moolchandani et al., 2022). A new algorithm has been developed for real-time feature-based stereo system for video processing, which is dynamic and seamless. Fuzzy logic theoryhas been used to replicate the movementsofa moveable robot head, resulting in an algorithm with greater accuracy and reduced computing time. The algorithm has been employed to develop relative navigation filters in localization and mapping applications. Additionally, the robotic platform has been equipped with a stereo vision sensor, and the authors have created kinematic motion models of three-dimensional generalizations for target tracking. The authors have utilized stereoscopic terrain mapping studies to demonstratethe effectiveness of their estimation methodologies.

LEARNINGOFINTELLIGENTROBOTIC

To teach computers how to classify information based on rules, machine learning algorithms are employed. In machine learning, there are two primary supervised methods: neural networks (NN) and support-vector regression (SVR). Some deep learning architectures use deep neural networks, which are a subset of neural networks. Researchers have proposed machine learning-based robotic systems that integrate neural networks with kinematics and its inverse equations to control robot arms. Their advanced training algorithm's learning rate was thousands of times higher than that of conventional feed-forward network learning methods.

ImageClassification

Theaccuracyofresults is influenced bythe featureselectionmethodemployed. Two main categories of vision approaches are passive vision and active vision. Image classification performance is achieved using deep CNN, which trains labelled data to learn features from raw pixels. A content-based retrieval methodology is proposed, which employs media objects such as photos, videos, and music relevant to a query as input to retrieve data from a database. Thecontent of the media items is used to determine the relevance of the input query. Images are pre- processed before being stored in a database and then clustered based on the different elements of the RGB model. The top-ranked images are subsequently clustered using the support vector machine algorithm (SVM) to extract relevant photos. Image mining is an interdisciplinary field that includes data, image processing, retrieval, statistics, recognition, vision, machine learning, and artificial intelligence. The primary objective of their proposed work is to extract photos rapidly and efficiently from the database. They assessed the fundamental mathematical theories andnotationforidentifyingandcharacterizingpicturefeaturesandexaminedvarious characteristics of ideal features (Laschowskiet al., 2022). The choice of feature selection method can significantly impact the accuracyof the results obtained. Inthe field of image processing, the use of static image characteristics like colour, texture, and geometry has been demonstrated to reduce system elapsed times in all target search techniques. Efficient extraction of rich semantics from auxiliary texts of photographs was proposed, and a high-speed classification method with smallmemoryrequirements for featurestoragewasdeveloped. TheK-Meansclusteringtechnique was used to analyse the results in terms of the time taken. Feature selection, also known as pre- processing, helps to identify and exclude extraneous attributes in a data source, resulting in a smaller subset of features that accurately describe the situation. Intrusion detection systems have employed feature selection to choose a small subset of attributes that are crucial for the detection process, which also speeds up classification and aids in interpreting the data. Objectcategorisation is improved by encoding the application's area features based on shape and scale details. The use ofMulti-columnDNN advancesthe stateofthe art inseveralimage classification datasets. Kinematics is used to transition the robot joints' system's angle coordinates to the Cartesian system's coordinates. Many researchers have used soft computing techniques to create decision-making systems and have proposed various feature selection methods, including genetic algorithms and incremental feature selection algorithms. The proposed algorithms improve classification accuracy while reducing the number of features and processing time. An intelligent conditional random field-based feature selection algorithm is required to create an effective intrusion detection system. The suggested algorithm improves classification accuracy and can be applied in various applications to improve detection precision (Mon, 2022).

FuzzyClassification

A novel method has been introduced for extracting object edges from images. Additionally, Omar Abu Arqub has proposed a unique approach for resolving fuzzy Fredholm- Volterra integral differential equations, which makes a significant contribution to the field of employing fuzzy rules for mathematical problem-solving. Furthermore, this paper presents an approach for using the Artificial Neuro-Fuzzy Inference System (ANFIS) with two uncalibrated cameras to estimate the visual stance of an indeterminate robotic manipulator, providing a practical ANFIS-based method for manipulating the cartesian coordinate system. Another new feature selection approach has been proposed for selecting the optimal number of features from the entire collectionofavailable characteristics. This studyalso proposes atechnique called fuzzy rule-based neuro-genetic classification algorithms to improve the accuracy of augmented photo classification (Ramesh et al., 2022).

ObjectGrasping

The analysis of robot image motion utilizes geometrical data. Grab spots for objects are identified using accessible object models and plane features in order to achieve real-time manipulation. An autonomous grasp planning system that represented objects as spheres, cylinders, cones, orboxes developed. Atele-operationrobotthat communicates simultaneous six- degrees-of-freedom movements interacts with a robot manipulator utilizing a non-contact vision- based technique. A geometric technique is employed to calculate the required unknown joint angles inorder to allow autonomous positioning ofa robotic arm. Images fromvarious angles are captured by a single wrist-mounted video camera. A 3-D solid model object is created andutilized by extracting object image silhouettes (Song et al., 2022).

SYSTEMARCHITECTURE

The proposed robotic medical support system's overall structure is illustrated in Figure 2. This system comprises ten main components: the user interface module, speech recognition module, voice-to-text conversion module, command identification system, knowledge base, decision manager (DM), image processing system, image capturing module, and object identification module (Rasheed et al., 2022).

UserInterface Module

Aside from menu screens and forms, the robot is also equipped with microphone and camera-based displaysystems for human interaction. Upon receiving user commands, the robot's end effector is programmed to move towards the target object. Additionally, the robot is able to detect medical supplies or other items and move towards them to retrieve and deliver them to elderly patients (Gu et al., 2022).

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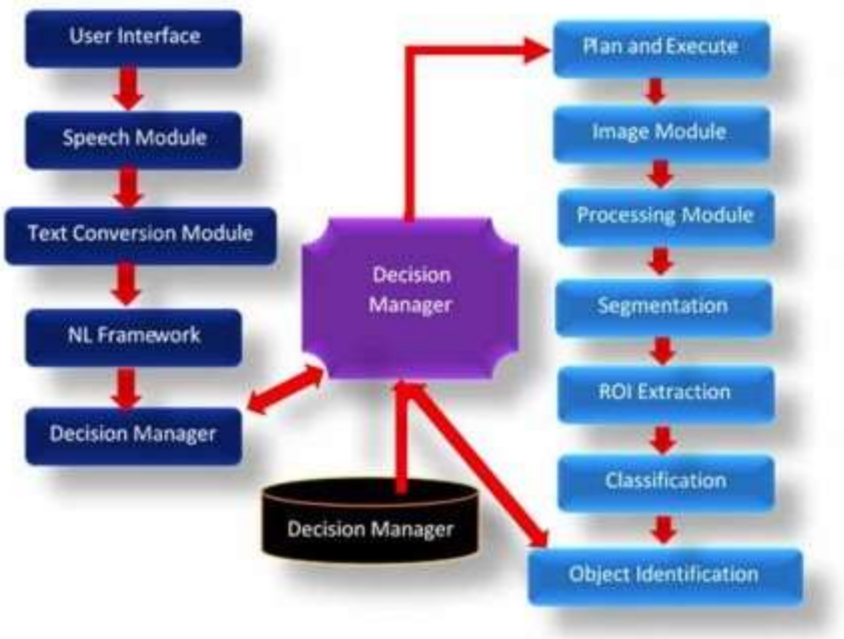

Figure2.Architectureofroboticmedicalsupportsystem

SpeechRecognitionModule

Speech recognition refers to the process of converting spoken words or acoustic signals capturedbya microphone intoasetofwords.This systemconsistsoftwomodulesthatrecognize boththe speechsequence and the individualwordswithin it. The first phase involvestraining the system to recognize voice commands, while the second phase evaluates its abilityto predict events in real-time (Pulikottil et al., 2018).

VoicetoTextConversionModule

TheproposedalgorithminthispaperistheIntelligentVoicetoTextConversion Algorithm(IVTCA). This moduleconvertstheuser'svoice intoMFCC features, whichprovidea good representation of the user's voice for system responses. The study has successfully converted voice messages to text format using the IVTCA. This algorithm outperforms other speech-to-text conversionsoftwareintermsofservicequality.It utilisesdeep learningtechniques toeffectivelysynthesisehumansounds, makingit moresuitableforfutureusewithmachine learning algorithms (Augello et al., 2022).

CommandIdentificationSystem

The robotic systemoperatesontextualcommands, allowing for a comprehensive analysis ofthe input priortoexecution. Evenspokencommandsarefirst convertedtotextformat. Thetext component of the input undergoes several natural language processing stages, such as tokenization and Parts of Speech (POS) tagging.

KnowledgeBase

The command identification system and voice-to-text translation module may generate sentences fromuser input that containambiguous,imprecise, oruncertainterms. To understand such sentences, the decision manager utilises the knowledge base. The module answers user inquiries and makes informed decisions. The knowledge base developed in this studyaims to supportdecision-makersinmakingmoreprecisedecisions.Storing,retrieving,andapplyingthe rules learned during model training and testing to make accurate judgments is the primary purpose of having a knowledge base (Zheng et al., 2022).

Decision MakingModule

The decision manager module controls all the other modules in the suggested system. When a user gives a command through the user interface, this module begins to operate. In addition to the knowledge base, command identification system, image capture and processing modules, object identification modules, and speech-to-text conversion modules, there are other modules. Thedecisionmanageroverseesanddirectstheentireprocessoftheproposedsystemby utilising the rules found inthe knowledge base. This module is responsible for making decisions about feature selection, categorisation, robot position, and object identification. It is linked to a robot that also has a plan-generation and action-module attachment.

ObjectGraspingModule

The decision manager is the key module that executes the user's commands in the robot system. Its primaryrole is to plan a path for the robot. The decision manager generates a second planthat leads fromtheobject's locationtotheuser's location. Whentherearemultipleobjectsto be identifiedandsearched, it employsheuristicsearchstrategiestolocatethedesiredobject inthe shortest possible time. This is accomplished bydividing the robot's coverage area into smaller regionsandprogressivelyincreasingthedistance betweentherobot andthetarget(Pachidiset al., 2020).

ImageCapturingModule

The stereo visionsystemutilisestwo camerasto captureimagesand create astereo vision configuration. The collected images are then transmitted to the image processing module, which processes a single frame of the robot and its surroundings. The robot's image-capture module determinesthecurrentorientationoftheobject and movesthecameratowardit usingtheobject's path. The image processing module continuously captures images of the object and creates a video. Individual frames are extracted from the video to generate photographs, which are then indexedusingR-treeindexingandstoredinadatabase.Thesephotoscanberetrieved fromthe database as needed (Ramesh et al., 2022).

ImageProcessing Module

Theimageprocessingmoduleisresponsibleforeliminatingnoise,extractingfeatures,and selecting the most relevant ones. It also performs image segmentation to identifythe area of interest.Thedecisionmanager modulereceivesthis information,andtheobject identifier module determines the object's location (Mon, 2022).

ObjectIdentificationModule

Thestereovisioncamerasystempreciselymeasurestheobject'sdepthbyreferencingthe environmental information stored in the database. The object recognition module utilises fuzzy temporal rules to identify objects effectively. Fuzzy temporal rules are employed to enable efficient inferenceusingthe forwardchaining inference method. Toperformtemporalconstraint propagation, constraint propagation techniques are used to build temporal constraint networks.

Discriminant networksaregeneratedduringtheinferencestagetobetterexecuterulematching and firing tasks (Mon, 2022; Moolchandani et al., 2022).

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