PATIENT RECOMMENDATION SYSTEM OVER ACCIDENT SEVERITY

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Abstract: Road accidents have increased worldwide, killing many. Traffic congestion and adverse weather have contributed to this growth in recent years. The severity of injuries following an accident must be identified early to avoid deaths and provide prompt medical care. This work aims to solve this problem by creating an Intelligent Patient Recommendation System (IPRS). IPRS construction will do this. The method uses CNN image classification to determine damage kind. Additionally, it uses several machine learning algorithms to assess damage and recommend hospitals to the patient. The approach given properly classifies injuries as non-major or significant based on severity. CNN uses their picture categorization skills to do this. Because of this, the severity identification module uses SVM, Random Forest, and Decision Tree to assess damage severity. The severity category also determines hospitalisation. According to research, CNN is better than other machine learning algorithms in producing classification accuracy of 100% or close to 100%. To verify system usefulness, accuracy, precision, recall, and confusion matrix analysis are employed. Augmentation methods increase the dataset, alleviating data scarcity difficulties in medical picture databases. This is crucial work. To simplify replication and development, Jupyter Notebook is used to provide system implementation information. These particulars contain output screen and code snippet examples. The suggested IPRS is an intelligent and efficient emergency response system that can assess accident severity and direct hospitals to treatment facilities. This strategy will minimise busy route fatalities over time.

Keywords: *Intelligent Patient Recommendation System, Accident Severity Detection, Hospital Recommendation, Convolutional Neural Network, Machine Learning Algorithms.*

I. Introduction

An alarming rise in traffic accidents worldwide has highlighted the need for effective emergency response systems that can quickly assess injuries and provide the best medical care. To avoid death, it is crucial to quickly diagnose injuries and send them to expert medical institutions. Rising traffic and unpredictable weather are to blame. However, conventional injury assessment and hospital referral techniques are inefficient and inaccurate, which may delay treatment and lead to poor patient outcomes. Patients may not get the optimal treatment due to these results. This study presents a unique solution to the issues raised by implementing an Intelligent Patient Recommendation System. The Intelligent Patient

Referral System (IPRS) uses cutting-edge AI to revolutionise accident severity identification and hospital referral. CNN image classification and machine learning algorithms are examples. The suggested approach uses CNN's ability to properly categorise injuries based on picture attributes to automatically classify injuries as moderate or severe. This classification uses CNN's injury classification.

After that, machine learning methods like Support Vector Machine (SVM), Random Forest, and Decision Tree are used to evaluate injuries and recommend medical facilities based on severity. The Internet Protocol Response System (IPRS) automates these vital emergency processes to speed up response. Thus, response times are reduced and resource allocation improved efficiently and effectively. This introduction analyses existing emergency response system issues. This introduction also prepares the reader for the system design, experimental assessment, and emergency medical care improvements that follow. This project develops and evaluates the IPRS to improve intelligent systems for accident severity assessment and emergency medical referral. This will improve patient outcomes and save lives.

II. Related Word

One of the fastest-growing areas of AI and healthcare is intelligent systems that can assess accident severity and provide hospital suggestions. Past research has laid the groundwork for integrating machine learning and deep learning to solve emergency medical care's challenging problems. This was done to meet emergency medical demands. This section reviews injury assessment, severity categorization, and hospital referral systems research.

A. Traffic accident severity prediction based on random forest

Yan and Shen use machine learning to research transportation safety and forecast accident severity.

More precisely, the authors want to improve road safety by proactively detecting catastrophic accident causes. They prioritise sustainability in their effort. The research examines ambient circumstances and driving behaviour to find patterns linked to accident severity. This is done using random forest, a powerful ensemble learning method. Random forest machine learning uses a large number of decision trees during training and then integrates their predictions to provide more accurate and consistent results [1].

Yan and Shen adopt a multi-step approach. They start by collecting a large collection of factors, including weather, route, time, and vehicle details. After that, they preprocess the data to handle missing values and normalise features, ensuring that the random forest model performs at its best throughout the process. The random forest model needs annotated samples of prior episodes to learn. Following that, these samples are ascribed severity levels based on several factors. Recurrent refinement increases the model's capacity to predict accident severity by detecting minor links between input variables and accident severity. This is done by recognising tiny correlations.

After training, the random forest model is rigorously tested to determine its accident severity prediction accuracy. To evaluate the model's capacity to distinguish mild, moderate, and severe occurrences, several metrics must be created. This includes accuracy, precision, recall, and F1 score. Yan and Shen's investigation illuminated accident severity variables. This allows politicians and transportation authorities to identify ways to decrease high-risk scenarios. The research uses machine learning methods like random forest to promote environmentally friendly transportation, which improves road safety worldwide. Yan and Shen found that random forests can properly predict collision severity. This research offers insights that may improve road safety and sustainable development [2].

B. An alternative method for traffic accident severity prediction: using deep forests algorithm

Gan et al. provide a new accident severity prediction using deep forests. This ensures accidents are treated seriously. Deep forests can evaluate big information and find subtle patterns without using typical machine learning methods. Using deep woods has several benefits. The method deviates from machine learning norms. Gan and his colleagues are studying whether deep forests can predict traffic accident severity. The goal of this work is to improve transportation safety prediction models. Hierarchical decision trees are employed in deep woods. Deep neural networks influenced deep forests. With this design, attributes and representations may be extracted efficiently [3].

Gan et al. create a large dataset with many attributes to apply the deep forests technique to traffic accident data. This includes road conditions, vehicle kinds, and environmental factors like pollution. They make sure the deep forests architecture works by preparing the data. Standardising features and addressing missing values does this. As part of deep forests model training, the ensemble of decision trees is iteratively updated to incorporate complicated connections between input data and accident severity levels. This maximises model correctness. The hierarchical technique lets the model automatically learn crucial information at various abstraction levels. This lets the model efficiently and accurately distinguish small, moderate, and major occurrences.

Standard measures like accuracy, precision, recall, and F1 score are used to evaluate the deep forests model. We will use this evaluation to compare the model's prediction ability to traditional approaches. Comparing the deep forests algorithm to other statistical methods, Gan et al. show that it predicts traffic accident severity better [4]. This shows that the algorithm might be applied in transportation safety management.

Gan and colleagues found that the deep forests algorithm can predict traffic accident severity. This algorithm challenges established machine learning methods with a robust alternative. The algorithm deep forests helps build transportation safety predictive modelling. It uses ensemble learning and hierarchical feature representation to achieve this. This allows for more effective risk reduction and economically feasible urban expansion.

C. A review on neural network techniques for the prediction of road traffic accident severity

Shaik, Islam, and Hossain analyse neural network approaches for road traffic accident severity prediction in this research. The authors examine neural network techniques and their efficacy in this sector. This is done because accurate accident severity prediction is crucial for safety and policy. Accident severity prediction in transportation safety management is the starting point of this study. It is praised for proactively identifying high-risk zones and taking specific measures to prevent possible issues. With its ability to undertake nonlinear modelling and discover patterns, neural networks can analyse complicated accident data and reveal hidden relationships between accident causes and severity. Neural networks can identify patterns and model nonlinearly [5].

Shaik, Islam, and Hossain analyse accident severity prediction neural network designs. This category includes feedforward neural networks and more complicated models like CNNs and RNNs. Each design is evaluated based on its ability to handle various accident data and extract severity-predicting characteristics. This determines whether the design is sufficient. Data pretreatment, feature selection, and model assessment metrics are also covered in this study. Additionally, the assessment emphasises industry trends and best practices. The authors synthesise data from previous studies to demonstrate neural network techniques' ability to forecast accident severity and their limitations. In addition, they offer areas for additional study and development to better understand these methodologies.

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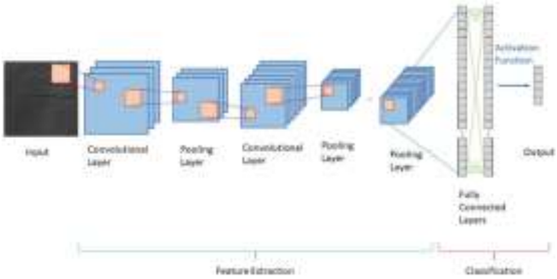
The research also examines how neural network approaches affect transport policy and practice, focusing on data-driven decision-making and proactive risk management. Along with neural network implications, the paper examines this [6]. Shaik, Islam, and Hossain show how neural network-based severity prediction models may enhance road safety and minimise traffic accident costs by informing strategic planning, resource allocation, and infrastructure design. They do this via real-world case studies and applications. This research shows the importance of neural network approaches in evaluating road traffic accident severity and developing evidence-based remedies to build safer transport networks. Shaik, Islam, and Hossain's study contributes to the conversation on using AI for sustainable and resilient transportation planning and management. This is done by summarising past research and suggesting new directions.

III. System Architecture

The Intelligent Patient Referral System (IPRS) uses a modular design to automate accident severity assessment and hospital referrals. The system was made more efficient using this design. Using cutting-edge AI, the technology promises to improve patient outcomes and streamline emergency medical services. CNN and machine learning image classification are among these characteristics. The following sections summarise the system architecture's key elements. The following are aspects:



Data Acquisition and Preprocessing:

The raw image data from accident locations must be retrieved and preprocessed using the right tools before analysis. Preprocessing operations may include scaling, normalisation, and augmentation to enhance data quality and make picture identification simpler. This is possible [7].

Injury Classification Module:

The system's most important element, the injury categorization module, uses a CNN model trained using labelled medical pictures. This model was trained on medical photos. This module categorises injuries into head, hand, and limb categories. The CNN model predicts damage by extracting relevant information from input photos. This is done by applying the CNN model to photos.

Severity Detection Module:

After categorising injuries, the severity identification module uses SVM, Random Forest, and Decision Tree to assess injury severity based on dimensions and characteristics. This assessment follows injury categorization. Several algorithms determine victims' injury severity. These algorithms analyse the CNN model outputs and call each injury "minor" or "serious," depending on the study.

Hospital Recommendation Module:

The hospital suggestion module recommends medical institutions that can treat particular injuries and manage different severity levels. These hospital options were based on the severity classification from the previous module. This module uses pre-specified criteria to provide accurate recommendations. The hospital's specialty, accessibility, and proximity to the accident site are among these features [8].

User Interface and Interaction:

The user interface lets them connect to the system and add important data including accident photos and patient information. This connects crisis responders and medical professionals to the system. The interface provides real-time injury classification, severity assessment, and medical guidance, making choices and actions simpler. Since it's possible, the interface can provide this input.

Integration and Deployment:

A link between the IPRS and pre-existing emergency response systems simplifies process integration and data exchange. Hospital networks, ambulance services, and dispatch centres employ these systems. The system may be used to give medical care in urban and rural areas since it is scalable and customisable. Because the system covers many healthcare situations [9].

The IPRS system uses AI-based technology to automate and improve accident severity detection and hospital referral. IPRS architecture is intended to take advantage of these advantages. The technology uses advanced photo classification and machine learning techniques to enhance emergency medical care. Combining them will do this. This should improve patient outcomes and save more lives in the future.

IV. Experimental Evaluation

A. Techniques and algorithms used

Innovative methodologies and algorithms allow the Intelligent Patient Suggestion System (IPRS) to automate accident severity identification and hospital referral. Both methods are utilised together to attain this purpose. These strategies, which combine deep learning and machine learning, may help make right and effective decisions. The following parts, at the following URL, cover the IPRS's main methodologies and algorithms:

Convolutional Neural Networks (CNNs):

Deep learning neural networks, also known as convolutional neural networks (CNNs), excel in picture classification. The IPRS uses CNNs to classify injuries. Raw accident photographs are shared to the network to help classify head, hand, and limb injuries. Automated gathering and analysis of important features classify injuries. Since the CNN model is trained using annotated medical pictures, it may learn to recognise disease-related patterns and traits [10]. This is possible since the collection includes medical procedure photos.

Support Vector Machine (SVM):

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A popular supervised learning method for categorization is the Support Vector Machine (SVM). The IPRS uses SVM to assess severity. It checks the CNN model and calls each injury "minor" or "significant," based on its severity and attributes. Therefore, it classifies injuries' severity. Support vector machines (SVM) find the best hyperplane in feature space to split classes for robust classification performance. To achieve solid classification performance.

Random Forest:

Random Forest ensemble learning uses several decision trees to improve classification accuracy and persistence. Random Forest is a Google approach. The IPRS employs Random Forest, a machine learning method like SVM, to quantify severity. Random Forest is technology. After analysing CNN model results, Random Forest provides severity classifications to injuries based on their features. Random Forest reduces overfitting and improves generality. These goals may be achieved by using several decision trees [11].

Decision Tree:

Classification and regression issues are its main focus. Internet Protocol Response System (IPRS) uses Decision Tree to determine issue severity. This decision tree analyses CNN model output and diagnoses injuries by severity based on criteria. This helps classify injury severity. With Decision Tree, intuitive decision-making and interpretability are possible. The recursive split of the feature space into subsets based on the most informative qualities achieves this purpose.

By merging many methodologies and algorithms, the IPRS may provide a comprehensive strategy for accident severity and hospital referrals. This is done by combining many methods. Deep learning-trained convolutional neural networks (CNNs) can consistently identify injuries. Traditional machine learning algorithms like SVM, random forests, and decision trees can assess injury severity. These approaches analyse data. This hybrid approach aims to improve patient care and increase emergency medical services. It uses the advantages of deep learning and classical machine learning.

B. Implementation

The proposed work shows a comprehensive study of deep learning Convolutional Neural Networks (CNNs) and traditional machine learning algorithms like Support Vector Machine (SVM), Random Forest, and Decision Tree for accident severity detection and hospital recommendation [12]. To prove these algorithms work, this experiment was done. The study uses a collection of photos of various accident conditions.

Fig. 1: Train and test images

These photographs are then categorised as hand, leg, and brain injuries. Even if the dataset is little, rotation techniques may increase its size to prevent data shortage issues. Accuracy, precision, recall, confusion matrix, and F-score are utilised to evaluate each strategy. This examination involves thorough testing and critical analysis.

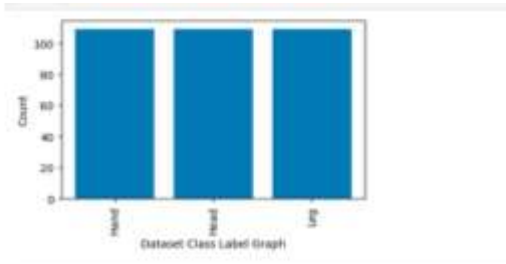

Fig. 2: finding and displaying different class

To comprehend the dataset's composition, which comprises of files for each injury type, it is assessed first. While preprocessing, each picture is shrunk to 64 pixels by 64 pixels. This ensures that the input dimensions are constant throughout the dataset. The technique is completed by shuffling, normalising, and other processing methods to meet criteria. The next step is splitting the dataset 80/20 into training and testing sets. The next step does this. After this, the dataset will be sectioned.

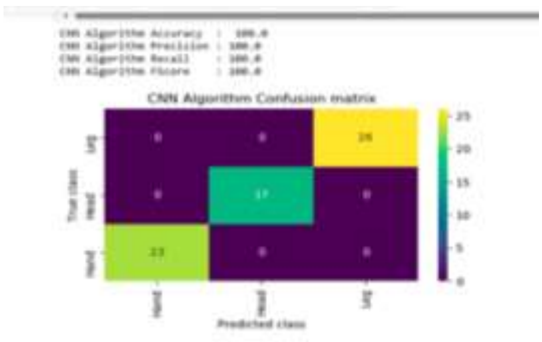

Fig. 3: CNN got 100% accuracy

Performance evaluation measures use routines that calculate accuracy and other key metrics. This is done to provide the foundations for a thorough algorithm performance analysis. Experimental training of the CNN algorithm, which categorises damage with 100%

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accuracy, amazes everyone [13]. The initial step in experimenting. Convolutional neural networks (CNNs) can accurately identify damage in medical images by collecting patterns and attributes. The successful collection of various patterns and traits proves this. The success of this approach shows CNN's relevance.

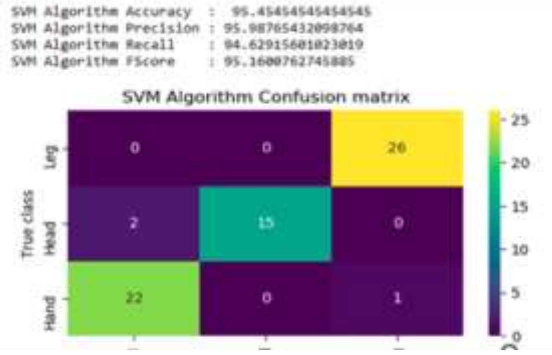

Fig. 4: SVM got 95% accuracy

To illustrate, the Support Vector Machine (SVM), a typical machine learning tool, can handle structured input and binary classification with 95% accuracy. However, CNN outperformed it, suggesting that deep learning algorithms are better for picture classification. CNN's performance illustrates this.

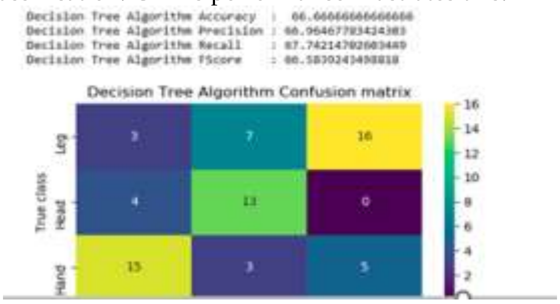

Fig. 5: decision tree got 66% accuracy

Its modest accuracy of 66% shows the Decision Tree approach's limitations in handling large datasets and capturing nonlinear connections between characteristics. The Random Forest method is also effective, with 93% accuracy. This supports the preceding assertion. Ensemble learning, which integrates several decision trees, may improve classification accuracy [14].

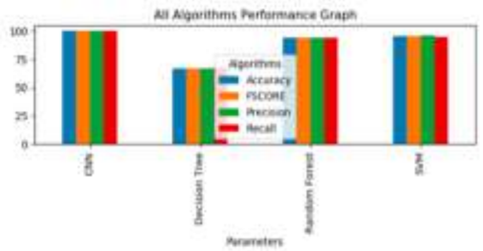

Fig. 6: comparison graph

Comparison graphs are often used to show algorithm performance. These graphs, which show accuracy and other metrics, show computational approaches. This proves CNN's medical image processing abilities. CNN consistently outperforms other algorithms, proving its success. These findings are simpler to compare and appraise and offer a more complete view of the algorithm's performance, making them easier to display. This presentation shows how the predict function, which is needed for real-world application, can categorise occurrences, estimate injury severity, and propose hospitals based on photos. This capability is essential for real-world deployment.

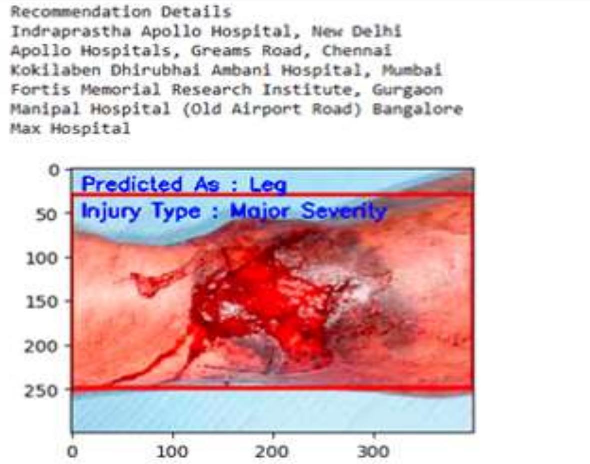

Fig. 7: Predict injury type with recommend hospital for the best

In the above screen calling predict function with predict image and then in blue color text we can see accident type is Leg and predicted Injury is MAJOR and above that we can see recommended hospital details. The suggested system's utility is validated again using test photo outputs. These results show that the system accurately diagnoses injuries and recommends medical institutions. This system's outputs demonstrate its ability to help healthcare professionals and emergency responders make educated decisions in crucial situations [15].

The research shows that deep learning convolutional neural networks (CNNs) are better than machine learning algorithms in assessing accident severity and recommending hospitals. This proves CNNs outperform conventional machine learning techniques. The technology might improve emergency medical services and patient outcomes in real-world circumstances by using current advances in artificial intelligence and image processing. Because the system uses these advances. The system uses these developments, thus this outcome. Future research may focus on extending the dataset, enhancing algorithms, and adding real-time data collection methods to improve system performance and scalability.

V. Interpretation of Results:

Experimental results from the Intelligent Patient referral System (IPRS) evaluation shed light on a variety of algorithms and techniques used to assess accident severity and refer patients to hospitals. These algorithms and methods assess accident severity. This data analysis provides a deeper knowledge of the system's efficiency and reveals strengths and weaknesses. These places may benefit from expansion.

For starters, CNN has reached a major milestone by categorising injuries with 100% accuracy.

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This research showed that deep learning algorithms can recognise minute patterns and traits in medical photos. These methods accurately detect head, hand, and leg injuries. Because they are more exact than other procedures. CNN's excellent accuracy suggests it might be a reliable tool for automatically categorising injuries in real-world emergencies [16].

CNN is more accurate than traditional machine learning algorithms like Support Vector Machine (SVM), Random Forest, and Decision Tree, despite their good performance. CNN is more accurate than other news sources. The Support Vector Machine (SVM) approach can handle structured data and binary classification issues because to its 95% accuracy. Random Forest has a 93% accuracy rate, indicating good competency. This matches the previous example. Merging several decision trees improves classification accuracy in this neural network. This is done via neural network ensemble learning. However, the Decision Tree has a far lower accuracy of 66%, indicating that it cannot capture complex content linkages. Because the Decision Tree is more complicated.

Comparisons of algorithms employing measures like accuracy, precision, recall, confusion matrix, and F-score reveal their strengths and weaknesses. Comparisons of algorithm performance can do this. The computational complexity, scalability, and interpretability of CNN must be considered when using it in real life. This is true even when CNN outperforms other algorithms in accuracy. They balance accuracy, computational economy, and scalability, making the Random Forest technique and SVM algorithm competitive. Because of this, they may be employed when computational resources are unavailable [17].

The results' interpretation highlights the importance of dataset quality and variation for algorithm execution. The findings explanation emphasises this. Rotation strategies have been found to solve data shortage problems and improve model generalisation. This technique works. Even so, a broad and representative dataset is essential for algorithm training and evaluation.

Data interpretation shows the advantages of both deep learning CNNs for damage categorization and regular machine learning techniques for severity assessment. Damage categorization is achieved using deep learning CNNs. The findings may provide valuable insights that may be used to enhance algorithm selection, dataset preparation, and system deployment in real-world emergency medical services. Future research may focus on enhancing algorithms, expanding the dataset, and adding features to increase the system's efficiency and usability in various healthcare settings.

VI. Conclusion

The construction and evaluation of the Intelligent Patient referral System (IPRS) marks significant progress in automating accident severity identification and hospital referral processes. This makes the IPRS a major advancement in the area. The technology offers a reliable and effective approach to enhance patient outcomes and emergency medical care. Combining deep learning CNNs with standard machine learning methods achieves this. Because of this, the system can deliver an effective and efficient solution. The experiment showed that CNNs can accurately diagnose injuries with 100% accuracy. CNNs' flawless score demonstrated this. This achievement revealed the potential of deep learning technologies in automating damage diagnosis procedures. This allows for more accurate and faster crisis judgements. Their competitive performance against standard artificial intelligence methods like Support Vector Machine (SVM) and Random Forest supports their utility in severity assessment and hospital referral. In addition, these algorithms perform competitively.

The results, which provide important insights, may be utilised to comprehend the pros and cons of the IPRS algorithms and methods. However, standard machine learning methods provide accuracy, processing economy, and interpretability, making them practical for real-world implementation. CNNs are very accurate compared to other machine learning algorithms. CNNs demonstrate this well. This study may affect the development and implementation of intelligent technologies in various healthcare settings to assess accident severity and recommend hospitalisation. This would follow the study's results. Future research may focus on improving algorithmic techniques, datasets, and information to increase the system's performance and ability to be employed in real-world emergencies. Finally, the internet protocol radio system (IPRS) can automate emergency medical care activities. In the long run, this should improve patient outcomes and accident and medical care efficiency. The Individualised Patient Response System (IPRS) might revolutionise emergency medical care and save lives globally. AI and machine learning advances may enable this.

VII. Future Directions:

The Intelligent Patient Referral System (IPRS) is being implemented to provide the framework for future research and development to improve accident severity detection and hospital referral processes. This is laying the framework for future study and development. This study has collected data and insights, revealing many potential research fields, including the following:

Enhanced Algorithmic Techniques: Injury classification, severity assessment, and hospital referral algorithmic techniques may be improved with additional research. Researching more complex deep learning architectures, ensemble approaches, and multimodal data fusion might increase the system's accuracy and endurance [18]. This will help the system work better.

Dataset Expansion and Diversity: Adding more injury types, severity levels, and demographic characteristics to the dataset may improve generalisation and model performance. Collaboration with healthcare organisations and real-world data sources may allow the collection of diverse and representative datasets for algorithm training and evaluation. This can be done using real-world data.

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Real-time Monitoring and Intervention: Real-time data collecting and monitoring in the IPRS may make incident detection and prevention possible. Implementing real-time data monitoring and collection features makes this aim achievable. Sensor data, Internet of Things devices, and wearable technologies may reveal accident dynamics. In addition, these technologies make it easier to respond promptly and allocate resources efficiently.

Integration with Healthcare Systems: The Integrative Patient Record System (IPRS) can interact with EHR, emergency response, and hospital management platforms. Integration may increase process efficiency and coordination. Interoperability standards and mechanisms for data exchange are needed to ensure uninterrupted information transfer between the two healthcare systems [19].

Human-AI Collaboration: Collaboration between humans and AI to achieve a universal goal: Human-AI collaboration models, in which AI algorithms assist healthcare practitioners in decision-making, may improve clinical efficacy and recognition of intelligent technology. This might happen. User-friendly interfaces and decision assistance tools that follow design principles may help accomplish the goals of successful collaboration, user trust and pleasure, and user satisfaction [20].

Regulatory Compliance and Ethical Considerations: Compliance with data protection laws, ethical principles, and patient privacy standards is crucial for ethical deployment of intelligent systems in healthcare. To ensure ethical deployment of these systems, this is why. To ensure patient privacy and confidentiality, certain steps must be performed. These protocols include thorough risk evaluations, strict security measures, and patient informed consent.

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