

DEVELOPMENT AND IMPLEMENTATION OF AN INTELLIGENT SUPPORT SYSTEM

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Abstract

The article describes an intelligent support system that detects human injuries both in normal life and in emergency situations, recognizes them and gives proper instructions to prevent future health issues.

Intelligent support system will use database, servers, AI (artificial intelligence) models and methods, back-end and front-end technologies and devices.

Up to 90% of the population in the country has a modern mobile phone (smartphone), and more than 80% of the population has the opportunity to use various Internet applications and services every day. Thus, the development and further use of an intelligent support system for the provision of remote assistance to victims in emergencies in the country, both technically and in terms of the population's readiness for high technology, is real and relevant.

Key words: support system, artificial intelligence, database, injuries, emergency situations, mobile application, server, device.

Introduction

Intelligent support systems (ISS) are systems that facilitate decision requiring the use of knowledge, intuition and experience. Most companies today have no trouble gathering data, but knowing what to do with that data is the tricky-and time-consuming-part. Even brilliant organizations are challenged with making smart business decisions after thorough data analysis. Bridging the gap between data analytics and decisions is where an ISS is incredibly useful [1].

When decision-making processes aren't working, an ISS can help companies navigate their data landscape and feel confident about their decisions. An ISS is used to gather and analyze data and then incorporate it into comprehensive reports. The decision support system methodology can be completely managed by artificial intelligence (AI), humans' decision makers or a mixture of both.

Techniques of artificial intelligence for decision-making or augmented analytics are a powerful way for businesses to use data to make smart business decisions confidently.

Intelligent support systems can take many forms whether it's a robot-advisor helping young people invest in the stock market or an online streaming service making TV show recommendations. Such systems are used in many spheres such as finance, healthcare, marketing, E-commerce, transportation, agriculture etc.

Radiologists use clinical decision support systems in the form of AI-powered image processing software to help in cancer detection. Likewise, ISS can be used to manage health informatics such as maintaining research information about specific protocols, preventative care and diagnosing illnesses.

Speaking more broadly, ISS can help healthcare companies analyze patient data to improve overall patient outcomes and reduce healthcare costs [2].

As a result of the chaotic process of industrial development of humanity, inappropriate attitude towards the environment, reckless use of natural resources, widespread non-observance of environmental norms and climate change has led to a sharp increase in emergencies in the world resulting in significant economic downturns, financial losses and, which is the most painful, many human victims. In particular, according to the latest data of the United Nations, Armenia ranks first in the world in the number of casualties due to emergency situations. Armenia continues to be threatened by a number of environmental disasters which have caused significant damage to the country's economy, environment and population over the past few decades [3].

According to the latest data from the World Bank, 80% of the population of Armenia is at high risk of emergencies: it means the country remains one of the most dangerous countries in terms of human losses, that is why preventive, rapid response, rescue and first aid measures are of special importance.

Scientific research

The results have shown that in order to effectively organize emergency prevention, first aid evacuation measures, special analysis and development, development, implementation and introduction of various intelligent support tools working in telecommunication networks are needed.

Conflict settings

The topic of research is the automated implementation of processes of emergency assistance to the victims of emergencies (in particular, remote diagnosis of injuries, remote medical care, remote health monitoring, etc.) and rapid efficient evacuation.

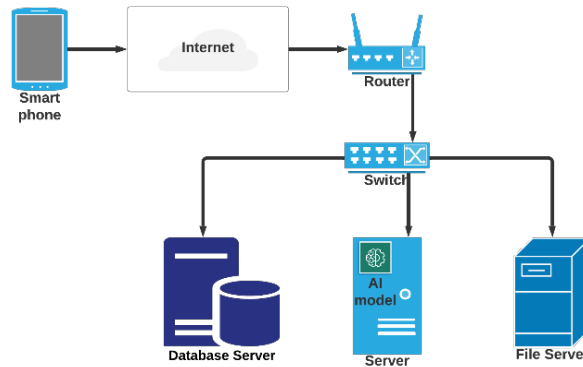
The main goal of the scientific research is to develop, implement and test on Armenian data to provide first aid remotely to emergency victims.

In order to achieve the goal of the scientific research described above, it is necessary to solve the following enlarged problems:

- Offer victims prompt and appropriate online medical consultation, treatment and health monitoring.
- Create architecture which should connect all components of support system.
- Investigate proper technologies for every component and choose the best one.
- Develop each component of support system.
- Develop an intelligent support system based on architecture and all components for victims.
- Test the developed system on the example of Armenia.

Research results

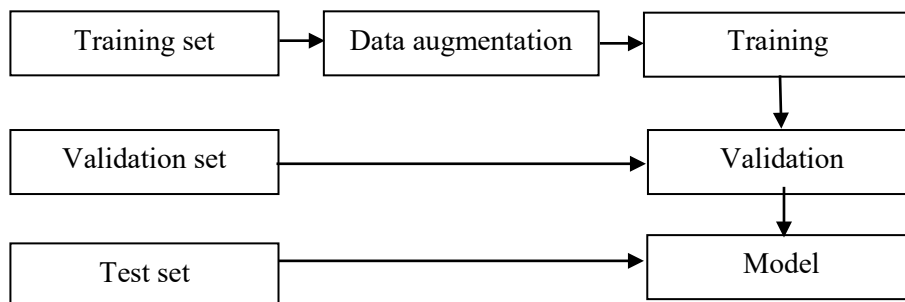
The architecture of the intelligent support system for emergency assistance, which will use AI models and methods, server, database, devices and proper technologies is shown in Pic. 1.



Pic. 1 Architecture of an intelligent support system

The first component of architecture is the AI model that should recognize type of injure based on neural network and classified dataset that is in database. To overcome this problem several researches that were done suggested Support vector machines (SVM) as the best model for classification. In this paper we study image classification using deep learning (DL) which assigns the appropriate class for the given image. For the implementation of the DL model a small dataset of images was collected and for such data supervised learning algorithms is used. Convolution Neural Network is chosen as the best option for the training process because it produces a higher percentage of accuracy (66.4%) than the SVM models suggested in other researches (SVM - 52%). As NN requires a large dataset, data augmentation tools were applied and the training set was increased from 345 to 3450. In terms of accuracy the result increased to 71.6% [4-6].

Before implementing CNN models all the images were resized into the same shape to properly learn the pattern of the 3 skins. In our case the images were resized to (150, 150, 3) size. The first two dimensions correspond to the height and width of the image (The number of pixels). The last dimension corresponds to the red, green and blue (RGB) colors present in each pixel. What the computer sees are the numbers that represent the intensity of the image in each pixel. High numbers represent parts of the image that are brighter, and low numbers represent parts of the image that are darker [7].



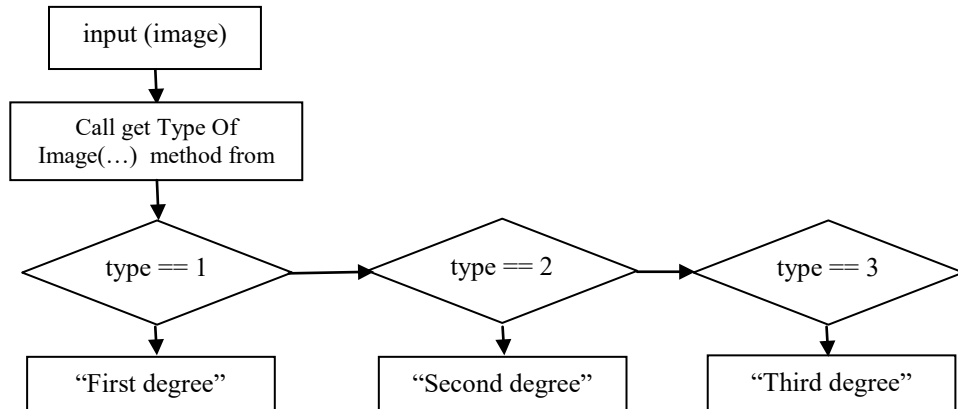
Pic. 2 Model of modified data classification

Before implementing a model of image classification, the data is splitted into

- training set to fit the model
- validation set to fine-tune the model hyper parameters
- testing set to provide an unbiased evaluation of a final model fit [4]

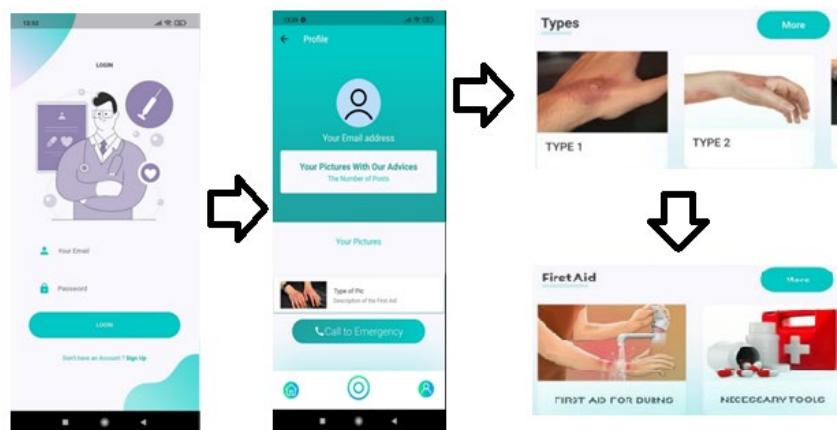
The overview of the image classification model is presented in Pic. 2.

The second component of architecture is the API that should connect the model of modified data classification and mobile application. For developing API, we don't need to do many researches, because it solves only connecting issue [6]. For that reason, API developed by using JavaScript/NodeJS as it is very simple and also have many opportunities to develop other features for support system in future. API implementation block scheme is presented in Pic. 3.



Pic. 3 Block scheme of API

The third component of architecture is mobile application. For the development and identification of various images of injures and for providing first aid information, Flutter technology is selected, as well as a mobile application that works on all operating systems [9, 10]. As an example, taken data of burn images and divided them to three categories by degree. As a result, the user will receive information about the type of injure and the necessary first aid through a photo of the injure taken from the phone. The work flow of mobile application for burn images presented in Pic. 4.



Pic. 4 Mobile application workflow

There are also additional functionalities such as call to Emergency, history and useful resources for users to know types of burns and how to provide first aid for proper cases.

Conclusion

This article introduces an intelligent support system which consists of an AI model, API and mobile application. In conclusion we have:

- created an architecture of an intelligent support system that connects a Smart Phone, Server that contains API and AI model, file server that contains burn images files and database server that contains relations by using internet and devices like router and switch.
- developed an AI model by convolution neural network which was proved to perform better than any other machine learning or neural network algorithms.
- developed API that gets an image via Smart Phone, sends it to the AI model and by image recognition gives the resulting degree of the burn. After the proper classification a corresponding first aid suggestion is generated and sent to the user via mobile application.
- investigated popular front-end frameworks and chosen Flutter/Dart technology for developing a mobile application that runs in all operating systems and provides a wide range of users.
- tested intelligent support system for dataset of burn images and got 75% accuracy.

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ԱԶԱԿՑՄԱՆ ԽԵԼԱՑԻ ՀԱՄԱԿԱՐԳԻ ՄՇԱԿՈՒՄԸ ԵՎ ԻՐԱԿԱՆԱՑՈՒՄԸ

Մայիլյան Ա.Կ.

Հայաստանի ազգային պոլիտեխնիկական համալսարան

Հոդվածում նկարագրվում է խելացի աջակցության համակարգ, որը հայտնաբերում է ստացած վնասվածքները ինչպես առօրյա կյանքում, այնպես էլ արտակարգ իրավիճակներում, ճանաչում դրանք և տալիս համապատասխան ցուցումներ՝ ապագայում առողջական խնդիրները կանխելու համար: Աջակցության խելացի համակարգը օգտագործում է տվյալների բազաներ, սերվերներ, արհեստական բանականության (ԱԲ) մոդելներ և մեթոդներ, back-end և front-end տեխնոլոգիաներ ու սարքեր: Երկրի բնակչության մոտավորապես 90%-ն ունի ժամանակակից բջջային հեռախոս (սմարթֆոն), իսկ բնակչության ավելի քան 80%-ը հնարավորություն ունի օգտվելու տարբեր համացանցային հավելվածներից և ծառայություններից: Այսպիսով, երկրում արտակարգ իրավիճակներից տուժածներին հեռահար օգնություն ցուցաբերելու աջակցության խելացի համակարգի մշակումն ու հետագա կիրառումն, ինչպես տեխնիկական, այնպես էլ բարձր տեխնոլոգիաներին բնակչության պատրաստակամության տեսանկյունից իրական է ու արդի:

Բանալի բաներ. աջակցության համակարգ, արհեստական բանականություն, տվյալների բազա, վնասվածքներ, արտակարգ իրավիճակներ, բջջային հավելված, սերվեր, սարք:

РАЗРАБОТКА И ВНЕДРЕНИЕ ИНТЕЛЛЕКТУАЛЬНОЙ СИСТЕМЫ ПОДДЕРЖКИ

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В статье описывается интеллектуальная система поддержки, которая обнаруживает травмы, полученные как в обычной жизни, так и в чрезвычайных ситуациях, распознает их и дает соответствующие инструкции для предотвращения проблем со здоровьем в будущем. Система интеллектуальной поддержки использует базу данных, серверы, модели и методы искусственного интеллекта (ИИ), back-end и front-end технологии и устройства. Приблизительно 90% населения страны имеет

современный мобильный телефон (смартфон), а более 80% населения имеет возможность пользоваться различными интернет-приложениями и услугами. Таким образом, разработка и дальнейшее использование интеллектуальной системы поддержки по оказанию удаленной помощи пострадавшим в результате чрезвычайных ситуаций в стране, как в техническом плане, так и с точки зрения готовности населения к высоким технологиям, является реальной и актуальной.

Ключевые слова: система поддержки, искусственный интеллект, база данных, травмы, чрезвычайные ситуации, мобильное приложение, сервер, устройство.

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