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Analysis of Deep Learning and Machine Learning Techniques in Healthcare Industries

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ABSTRACT: Both artificial intelligence (AI) and machine learning (ML) have made significant strides in recent years in a wide variety of industries, including the field of medicine, which is one of those industries. The term "artificial intelligence" is commonly used to refer to computer programmes that imitate and simulate human intelligence (AI). One of the subfields that fall under the umbrella of artificial intelligence is referred to as "machine learning" (AI). This is achieved by conducting an analysis on the raw data and locating patterns within them. Students could reap the benefits of this research by gaining a deeper understanding of machine learning and how it can be applied in the field of medicine. In this article, we investigate recent studies that investigate how the application of deep learning technology can improve medical care. Deep learning technologies have been shown to hold the promise of transforming vast amounts of biomedical data into tangible gains in human health, according to research that has been conducted. There are, however, a few drawbacks, as well as a need for improved technique development and application, particularly for both professional and amateur scientists. We propose building interpretable architectures that are both comprehensive and meaningful as a means of bridging the gap that currently exists between deep learning models and the interpretability of those models by humans.

KEYWORDS: Deep learning; Healthcare; Machine learning;Precision medicine.

I. INTRODUCTION

Research in the medical field is beneficial to society because it may result in significant medical advances such as new treatments, tests, vaccines, and preventative measures, as well as other general changes that affect healthcare and the manner in which it is provided to the general public [1]. The healthcare industry is one of the most problematic fields when it comes to the collection and processing of patient data. There has been a meteoric rise in the amount of patient data that contains multiple dimensions as a direct result of the advent of the digital age as well as the progression of technology. This data also includes information about clinical parameters and the resources that are available at the hospital. Patient records and the many different kinds of medical equipment are two of the places where this information can be found. In the years to come, the field of medicine will place a greater emphasis on the utilisation of the ever-increasing quantities of biomedical data that are being collected. This shift in focus is expected to take place in order to improve patient care. The purpose of precision medicine is to guarantee that the correct course of treatment will be carried out on the correct patient at the correct time. It is possible to accomplish this by conducting an analysis of the patient's data, which may include the patient's molecular characteristics, environment, electronic health records (EHRs), and lifestyle [3, 4].

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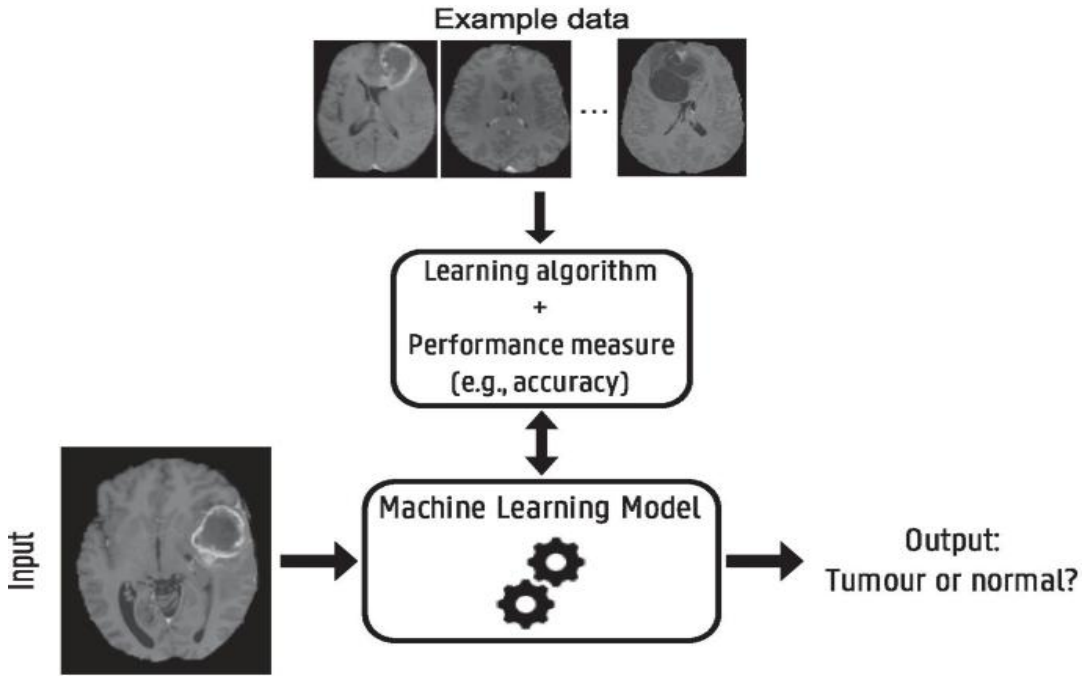

Fig. 1. Flow diagram of Machine learning model

A classical model with some parameters is given an MRI of the brain as an input, and its goal is to determine whether or not the scan reveals the presence of a tumour as an output [9]. To improve a particular performance metric, a learning algorithm modifies the model parameters in accordance with the example data provided. This example data may include labelled brain MRI scans[10]. After the training has been finished and the model has been shown to be capable of detecting tumours in new MRI scans, it will be possible to use it to detect tumours in new MRI scans [5-8].

The use of machine learning (ML) is becoming increasingly widespread in the healthcare industry. ML helps patients and clinicians by resolving operational challenges and establishing a more unified system to facilitate the streamlining of work operations.The process of automating medical billing is one of the most common applications of machine learning in the field of medicine. Clinical decision support and the development of clinical care recommendations are two additional applications of machine learning in the field of medicine [11]. A large number of notable high-level applications of machine learning and healthcare principles can be found in the fields of science and medicine. [12] You'll be able to locate these applications in a wide variety of different environments. The MD Anderson Cancer Center is the first organisation in the world to develop a medical machine learning system with the goal of predicting acute toxicities in patients who are undergoing radiation therapy for the treatment of head and neck tumours. Researchers working at the centre developed this system [13]. Deep learning in radiology identifies complicated patterns automatically and assists radiologists in making intelligent judgments based on the insights obtained when evaluating images such as conventional radiography, CT scans, MRI scans, PET scans, and radiology reports. For example, deep learning in radiology can help radiologists make intelligent judgments based on the insights obtained when evaluating images.Deep learning in radiology is a relatively recent development in the field of medicine. Imaging techniques such as positron emission tomography (PET), computerised tomography (CT), magnetic resonance imaging (MRI), and nuclear medicine imaging are all utilised in order to achieve this goal [14]. It has been discovered that automatic detection and diagnosis systems that are based on machine learning can perform just as well as an experienced radiologist. The healthcare machine learning programmes developed by Google achieved an accuracy of 89 percent when trained to diagnose breast cancer. This puts them on par with or above radiologists in terms of diagnostic capability [15].

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II. LITERATURE SURVEY

Initially, the authors provided a summary of the deep learning framework and highlighted the benefits of using it in place of more conventional learning approaches[16]. Following that, the researchers examined some research articles on the application of deep learning in the field of medicine, particularly in the fields of medical imaging, electronic health records, genomics, and mobile applications. They present challenges, but in addition to those challenges, they also present opportunities for more in-depth education within the healthcare industry [25].

The researchers investigated the fundamentals of machine learning and how they relate to the field of healthcare through the course of their research. This part of the article will start by presenting a high-level overview of the process of providing healthcare, along with its various stages. There are four distinct stages that can be distinguished within the process of providing medical care; these stages are referred to as prevention, diagnosis, treatment, and monitoring, respectively [17]. After a concise introduction to the process of machine learning, several machine learning algorithms, such as supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning, are then dissected in great detail [18]. Following that, the author conducted research into several different applications of machine learning, including the diagnosis of diseases, the production of pharmaceuticals, the execution of robot-assisted surgery, and the analysis of medical data. In this piece of writing, the author focuses on medical data analysis and the difficulties that may come up as a result of conducting such an analysis [19]. The researchers conducted research on the techniques of machine learning as well as the applicability of those techniques to heart failure. In order to accomplish this goal, the authors present a concise overview of machine learning as well as its applications in the medical field. They also talked about some important factors to take into account when developing machine learning models[20]. Deep learning, supervised learning, and unsupervised learning are the three subcategories that are determined by the learning model when classifying machine learning-based methods[21]. The methods of machine learning are then separated into three primary categories according to the application: diagnostic, classification, and heart failure prediction. The authors finished up by discussing the difficulties and roadblocks that machine learning faces in the medical field [22].

III. PROPOSED MODEL - DEEP LEARNING BASED ALGORITHM

Machine learning and deep learning have become critical components of the industry. Deep learning has had a tremendous effect in healthcare, allowing the industry to increase patient monitoring and diagnosis.

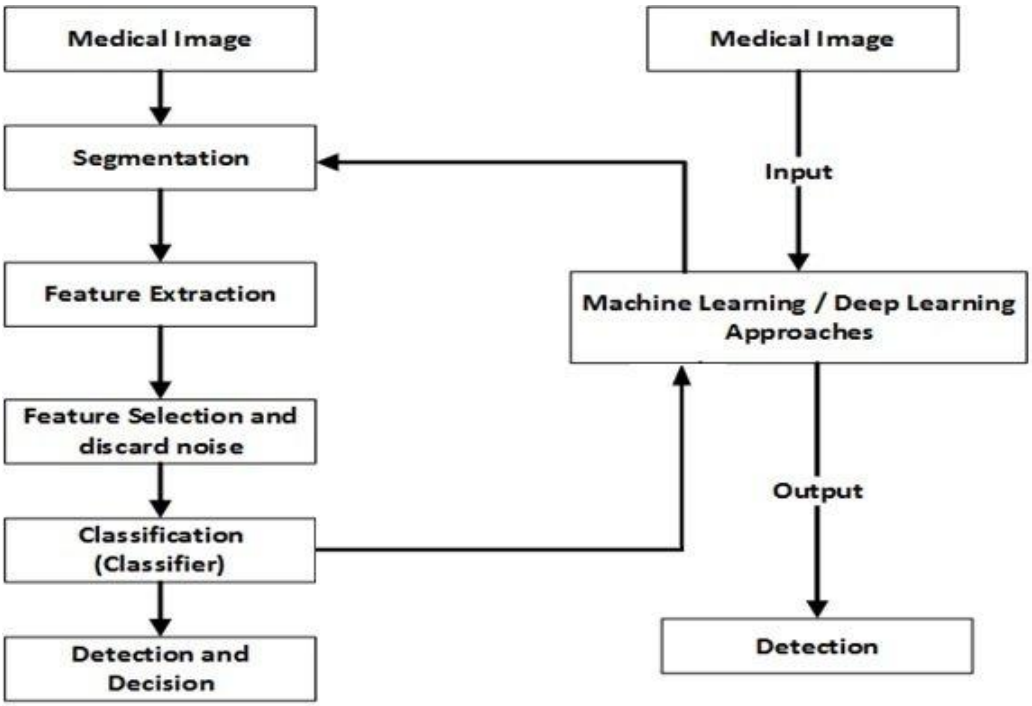

Fig. 2. Proposed model

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Deep learning, also known as hierarchical learning or deep structured learning, is a type of machine learning in which data is analysed by means of a layered algorithmic architecture. Deep learning is a subset of machine learning. In deep learning models, information is refined by passing it through a hierarchy of many layers, with each subsequent layer basing its conclusions on the results of the layer that came before it in the hierarchy. Deep learning models become more accurate as more data is processed, effectively learning from their previous outputs to improve their capacity to create connections and correlations as a result of this learning. The study of how biological neurons in the brains of animals link with one another to process information is the foundation of deep learning. When one layer of nodes receives impulses from the neurons that surround it, the subsequent layers of nodes also become active. This is analogous to the way that electrical signals travel between the cells of living organisms. It is possible for each layer of artificial neural networks (ANNs), which serve as the basis for deep learning models, to be given a particular component of a transformation task. Additionally, data may pass through the layers an excessive number of times in order to refine and optimise the end result. These "hidden" layers are responsible for carrying out the mathematical translation operations that are necessary to transform unprocessed input into understandable output.

The discovery of new medication combinations can be greatly aided by the application of deep learning. During the outbreak, disruptive technologies such as artificial intelligence (AI), machine learning, and deep learning were used to fund the development of vaccines and medicines. Since the development of drugs is a challenging endeavour, deep learning has the potential to help make the process simpler, more cost-effective, and more efficient. The capabilities of deep learning algorithms allow for the prediction of drug characteristics, the forecasting of drug-target interactions, and the creation of molecules with the desired properties. It is possible for deep learning algorithms to process genomic, clinical, and population data very quickly, and a variety of toolkits can be used to identify patterns in the data. Researchers can now use machine learning and deep learning to conduct faster molecular modelling and predictive analytics in order to identify protein structures [23], [24]. The use of medical imaging in deep learning models, such as X-rays, MRI scans, and CT scans, can aid in the diagnosis process. When it comes to medical images, algorithms have the potential to identify any potential risks and irregularities. In the process of cancer diagnosis, deep learning is used quite frequently. Machine learning and deep learning have enabled significant advances in computer vision. It is simpler to treat disorders with a faster diagnosis through medical imaging[26]. For image segmentation, disease identification, and prediction, Magnetic Resonance (MR) and Computed Tomography (CT) techniques use image recognition and object detection. A mixture of elements of imaging data, such as tissue size, volume, and form, can help deep learning models make appropriate interpretations[27]. Important sections in photos can be highlighted using these models. Deep learning algorithms are utilised to diagnose diabetic retinopathy, Alzheimer's disease early detection, and breast nodule identification via ultrasound. Most pathology and radiology photos will be studied in the future thanks to new advancements in deep learning[28]. Deep learning methods make complex data processing easier, allowing irregularities to be identified and prioritised with greater precision. Convolutional neural networks (CNNs) deliver insights that help medical professionals detect health issues in their patients more quickly and correctly[29].

1. Applications of Machine learning in healthcare using deep learning

a. Simplifying Clinical Trials

Clinical trials are time-consuming and costly[31]. Machine learning and deep learning can be used to perform predictive analytics in order to discover possible clinical trial participants and allow scientists to pool people from various data points and sources. Deep learning will also allow for continuous trial monitoring with minimal human interaction and errors[30].

b. Personalized Treatment

It's easier to assess a patient's health data, medical history, vital symptoms, medical test results, and other information with deep learning models. As a result, healthcare providers are better able to understand each patient and give them with individualised treatment. These game-changing technologies allow for the detection of appropriate and multiple treatment alternatives for various individuals. With real-time data collecting through linked devices, machine learning models can employ deep neural networks to forecast forthcoming health issues or hazards and deliver precise treatments or medicines[32].

c. Improved Health Records and Patient Monitoring

Machine learning and deep learning structure can handle and evaluate both structured and unstructured medical and healthcare data[33]. Manually classifying documents and keeping up-to-date health data may become

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laborious. As a result, smart health records can be maintained using machine learning and its subset deep learning. With the introduction of telemedicine, wearables, and remote patient monitoring, there is now an abundance of real-time health data, and deep learning can assist in intelligently monitoring patients and predicting hazards[34].

d. Health Insurance and Fraud Detection

Deep learning is a powerful tool for detecting insurance fraud and predicting future hazards. Deep learning gives health insurance providers an advantage since the models can predict future trends and behaviour, allowing them to recommend smart insurance policies to their consumers[35].

e. **Genomics**–

Deep learning is used to comprehend a genome and to assist patients undergoing therapy in gaining a better understanding of the disease that may impact them in the future.[25] With the support of the insurance industries, genomics is a sector that is rapidly increasing, and deep learning is poised to have a bright future. Deep learning algorithms are utilised to improve the speed and accuracy of medical field researchers and clinicians[36].

f. Cell scope –

A Cell scope is a device that uses deep learning technology to assist parents in keeping track of their children's health issues and status[37]. This technology may be viewed on any device and reduces the number of times parents visit hospitals or health-care facilities to see their children or chat with a doctor[38].

1.1. Benefits of deep learning in medicine:

a. Reduced cost of medical care

Deep learning in healthcare has the potential to drastically reduce hospital costs across the board, from medical diagnosis to finances. Medical professionals may spend hours poring through patient records in order to get the essential data and reach the appropriate conclusions. Using DL algorithms to accomplish this can assist medical organisations in closing this massive inefficiency gap[39].

End-users can check all available information much faster with DL-based solutions, giving them insights into their areas of responsibility. This enables hospitals to deploy highly valued professionals where their expertise is most required. Deep learning in medicine helps enhance the outcomes of any data-driven workflow by providing correct results faster[40]

b. More accurate diagnoses

With access to EHR and other medical data, a trained DL algorithm may swiftly synthesise various pieces of case-related information to deliver an appropriate diagnosis. As a result, doctors can begin therapy more quickly, which can save lives in life-threatening situations. Faster diagnoses also help healthcare practitioners minimise their usual workload, allowing them to devote more time to patient care[41]

Furthermore, utilising deep learning in healthcare can assist reduce readmissions. Doctors might acquire insights they might otherwise overlook and establish more effective treatment plans when the DL algorithm evaluates all data relevant to each patient. This may reduce the likelihood of readmission[42].

c. Decreased number of errors

Medical faults are thought to kill 250,000 individuals in the United States each year. DL-based solutions, unlike physicians, do not overlook or neglect anything. The methods used in deep learning are complex and accurate, and they can analyse large amounts of data from a variety of sources. This allows DL algorithms to assist doctors in making informed decisions, which would otherwise be impossible or time-consuming. Whole of this contributes to a reduction in medical errors[43].

DL models can also examine existing treatments and diagnostic data, permitting errors to be identified before they risk a patient's health and well-being.

d. Better use of available data

As previously said, medical facilities collect massive amounts of data but rarely use it to its full potential. When DL algorithms are applied to data acquired by a healthcare institution, physicians are able to

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fully evaluate the data and receive useful insights about care efficiency and administrative processes.This helps with both general outcomes (disease diagnosis, medication discovery, and so on) and individualised patient instances, where accurate diagnoses allow doctors to choose appropriate treatment regimens more quickly[44][45].

IV. CONCLUSION

In order for deep learning to be successful in radiology, extremely large data sets that have been meticulously annotated are required. This is due to the complexity of deep networks, the fact that computer software and hardware are constantly being updated, and the fact that recognising minute differences in the states of illness is more difficult than recognising differences in other types of things. It is anticipated that the application of machine learning in the field of radiology will have a significant clinical influence in the not-too-distant future as imaging procedures become routinely carried out in clinical settings. Because of this, there will be an opening for improving the level of decision assistance provided during the interpretation of medical images. The significance of the term "decision support" lies in the implication that computers will provide assistance to humans during the decision-making process, thereby leading to decisions that are both more effective and efficient.

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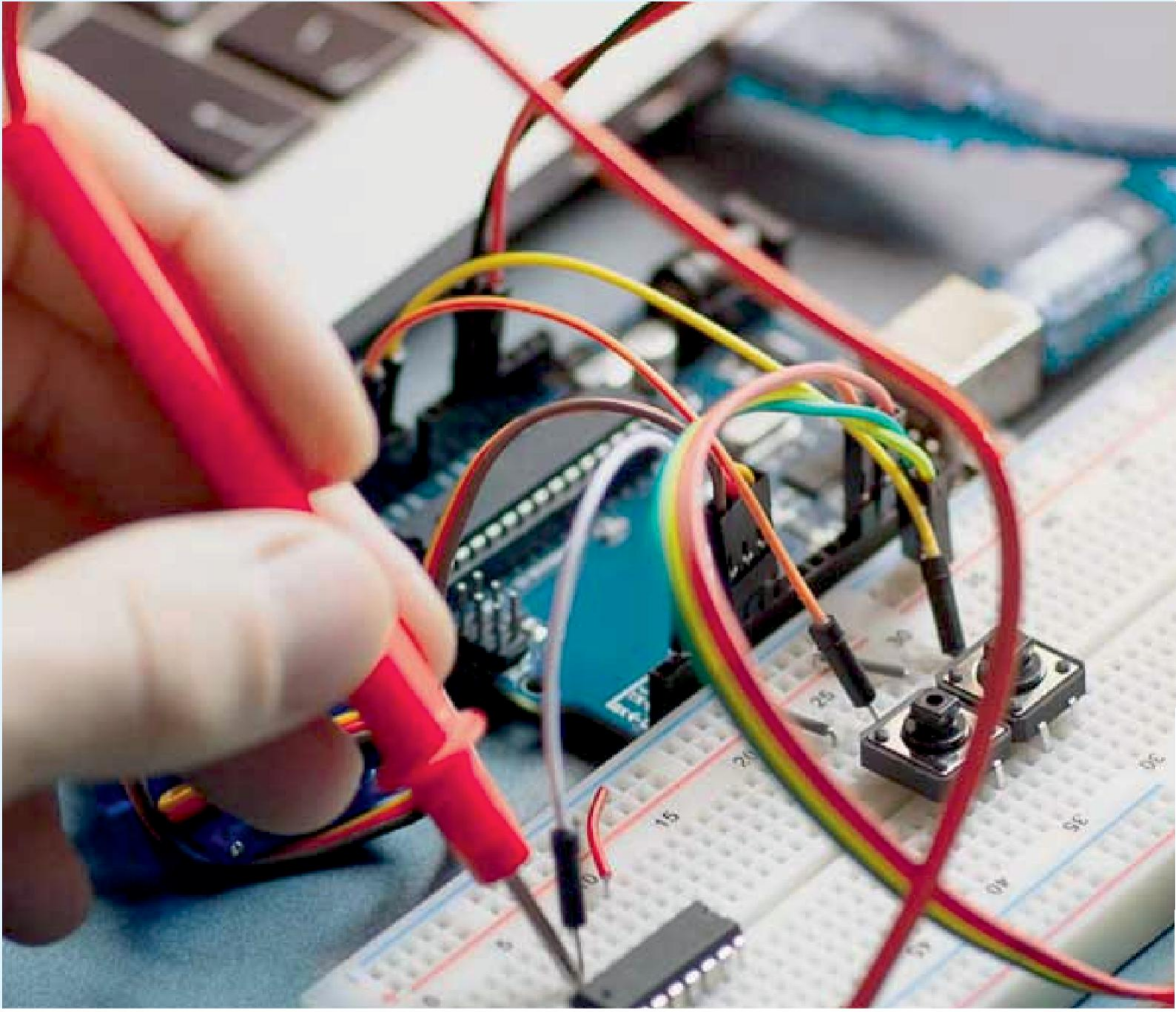

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