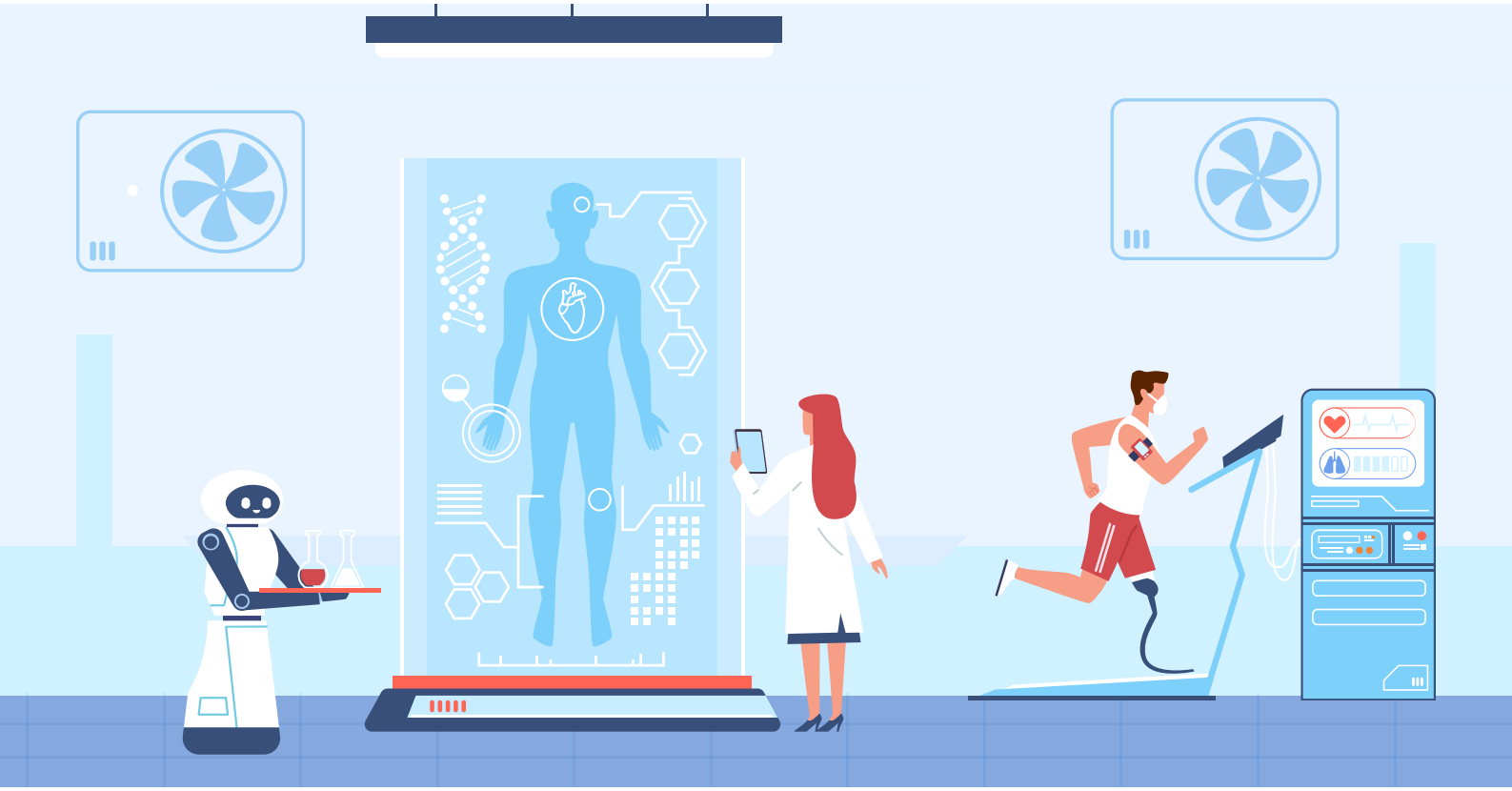
AI Usecase

AI FOR MEDICAL IMAGING APPLICATIONS

AI for Medical Imaging Applications

Medical imaging has been one of the most significant technological advancements in healthcare. This is because of the introduction of advanced medical equipment and techniques, which have improved diagnostic capabilities, treatment outcomes, and patient safety. AI can be a game changer for medical imaging by offering novel solutions that provide better results at lower costs.



Challenges

Acute care, cardiovascular, oncology, neuroscience, image-guided procedures, screening, etc are a few major drivers for medical imaging growth. However, medical imaging is facing several challenges, but these challenges can be overcome with the help of AI.

- **Availability of quality labeled data -** Accessing large datasets for training in the medical field is not as simple as it used to be. Some databases are incredibly powerful because they contain a vast amount of images that are accurately labeled. However, the volume of such labeled images remains several orders of magnitude behind. The development of deep learning-based medical imaging applications is hindered by the lack of labeled large datasets. Image annotation, such as assigning radiological labels to MRI scans, is a complex process that requires considerable domain knowledge and experience.

- **Non-standardized acquisition of medical images -** Different scanner types and image acquisition settings can lead to challenges in training artificial intelligence algorithms. A large dataset is needed to account for the variety in data and ensure robustness in the deep learning network. As more data is processed, the need for training data increases.

- **User-friendly -** One of the most frequent complaints that radiologists have is the user-unfriendliness of the radiology software they use. Because it is generally very user-unfriendly, it requires too much waiting time, too many clicks, and once you are in the program you cannot live without the manual by your side. This is not only frustrating but also highly unproductive.

Solutions

The potential of AI and machine learning to improve the way radiologists practice their profession is immense. One of the most promising uses of these technologies is in the detection of cancer, along with tumor detection, region of interest analysis, etc. 3. The application of different ML techniques such as image processing, image segmentation, and image classification can help reach the goal of improving the daily radiological workflow. This would then increase the efficiency, accuracy, and reliability of the medical services provided.

- **Image augmentation -** Machine learning experts have developed image augmentation techniques, which can be used to trick a network into thinking that there are more training examples available than there actually are. An image augmentation technique involves randomly applying changes to an image data set by translating, rotating, flipping, stretching, shearing, or elastic deformation of medical images. This process increases the variability in the data. For example, if you have a total dataset consisting of 500 MRI images of the brain, then you can add 5 random alterations to each image to give you 3000 images that can be used for training.

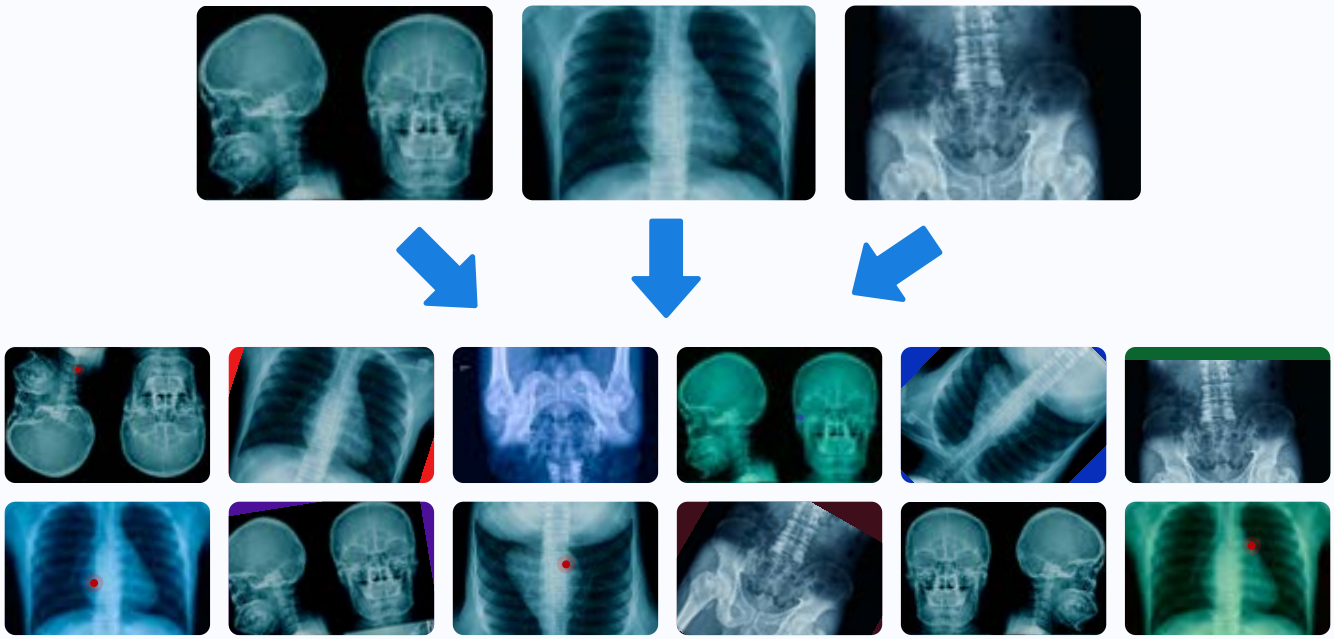


Image Augmentation

- **Transfer learning -** Transfer learning, a branch of machine learning, manages the discrepancies between training and test data. Models are first trained with a source dataset and then fine-tuned with the target task, which has proved to be beneficial when there is insufficient target data. A typical example where this method is employed is medical imaging, as it is often difficult to collect related data. The benefits from transfer learning increase with reduced data size and smaller distances between the source and target domain.

- **Data protection and model explainability -** A crucial element of ML models is data protection and privacy into account. This means accessing large datasets that have been anonymized, de-identified, and encrypted. By doing so, patient data remains secure. With explainable AI, it is ensured that the ML models are transparent and secure for healthcare providers to monitor the effects of AI. Furthermore, providing a valid explanation of the workings of AI to the affected patients and other relevant parties, such as HIPAA and GDPR, is necessary.

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