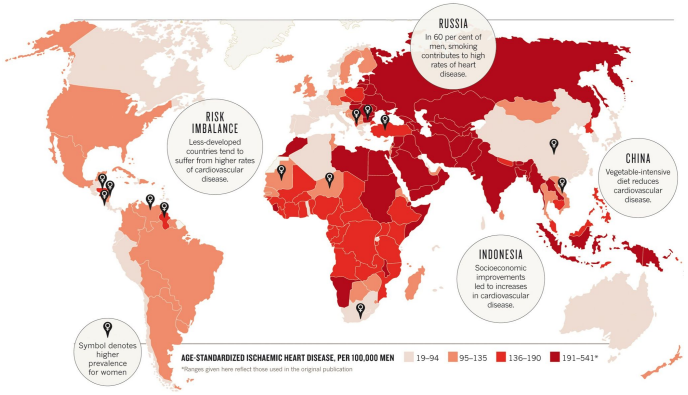
AI4SPECT: Improving the Accuracy of Deep Learning Based Detection of Coronary Artery Disease using SPECT Imaging

Presenter: Pranav Vyas

Research Context

Overview

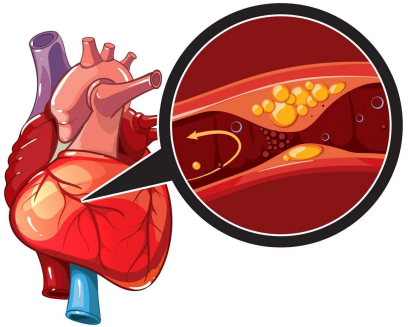
- Coronary Artery Disease is one of the leading causes of deaths across the world
- According to the World Health Organization
  17.9 million people die each year
  due to heart disease



Source: www.nature.com

Primary Causes of Coronary Artery Disease

- Coronary Artery Disease is caused due to a reduction of oxygen delivered to the myocardium
- Caused by atherosclerotic plaque forming in the lumen of blood vessels



Source: www.keyholeheartclinic.com

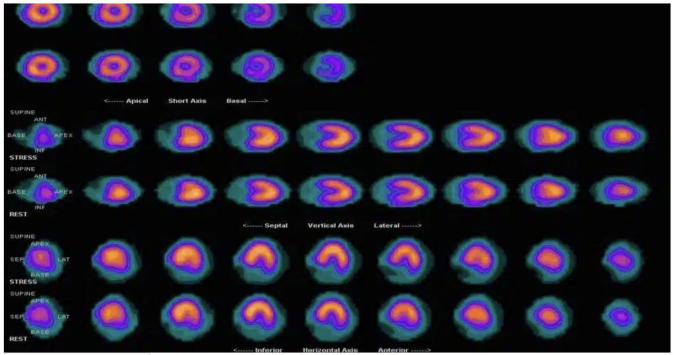
Diagnosis of Coronary Artery Disease

- Cardiologists obtain radiotracer distribution in the heart
- Using a non-invasive imaging method such as Myocardial Perfusion Single-Photon Emission Computed Tomography (SPECT)
- Visual evaluation of the SPECT images is largely dependent on the experience of the cardiologist

Source: www.guideir.com

SPECT Scans

- A SPECT scan of the heart is a noninvasive nuclear imaging test
- Uses radioactive tracers that are injected into the blood vessels to produce pictures of the heart
- Shows how well blood is flowing to the heart and how well the heart is functioning

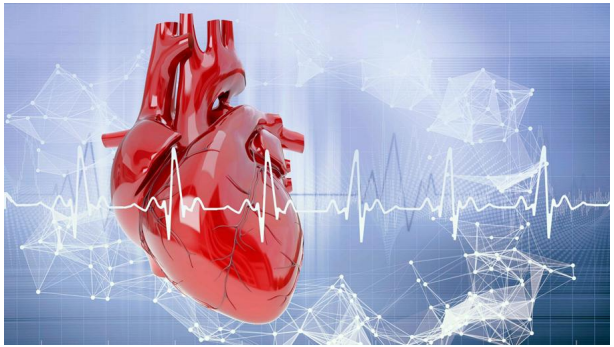


Source: www.openmedscience.com

Research and Analysis

Research Methodology

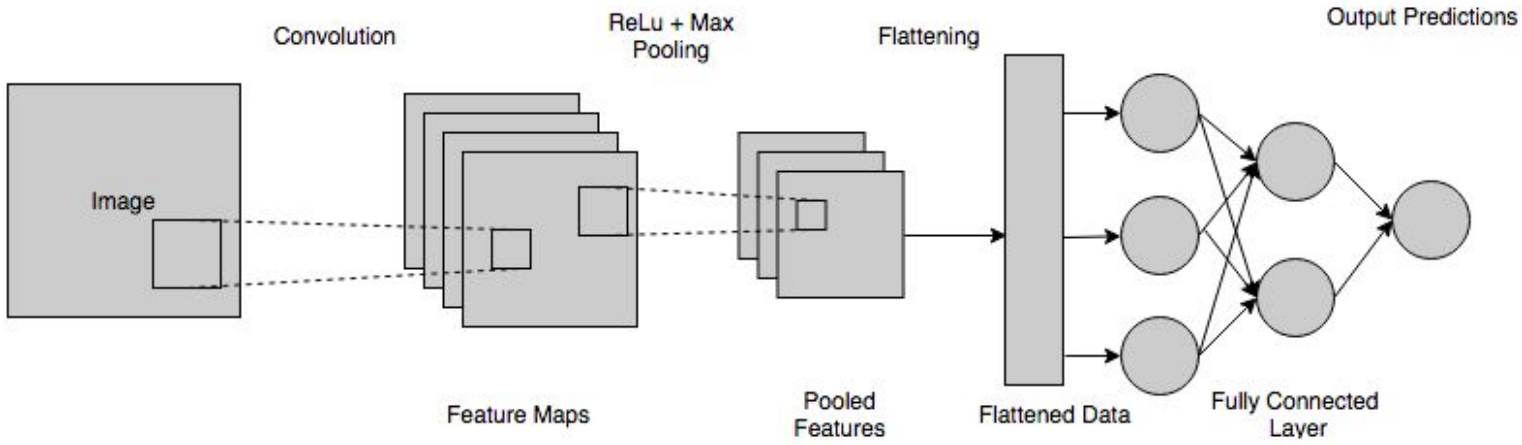
- Assessing the performance of Convolutional Neural Networks (CNN)
- Detecting abnormalities using transfer learning to classify SPECT images



Source: www.iotm2mcouncil.org

Convolutional Neural Network Models

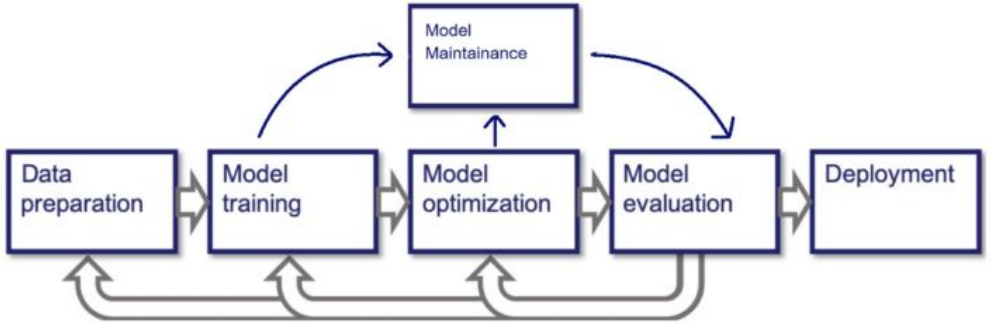
- CNN Models can be tuned for image classification to detect patterns in images



Source: www.projectpro.io

Training Deep Learning Models

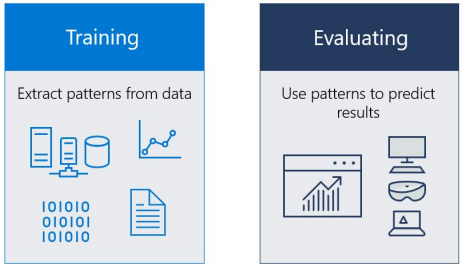
- An anonymized dataset containing summed stress and rest images from 192 patients was used in this study
- The research process included normalization of images followed by image augmentation for Deep Learning using CNN models



Source: www.datatron.com

Results

- Overall classification accuracy of the CNN models is 90.24%
- The error rate of 9.76% is caused due to variability in the manifestation of lesions such as Calcified Atherosclerotic plaque in the SPECT images



Source: learn.microsoft.com

Analysis of Results

- The prediction results show higher accuracy for the CNN models as compared to the existing approaches used in cardiovascular medicine
- Additional research to focus on tuning the models to detect variability in the manifestation of lesions

Source: info.keylimeinteractive.com

References

Research Sources and Datasets:

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- https://www.heart.org/en/health-topics/consumer-healthcare/what-is-cardiovascular-disease
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Images:

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Thank You!