Classification of Myocardial Perfusion SPECT Images through Deep Learning

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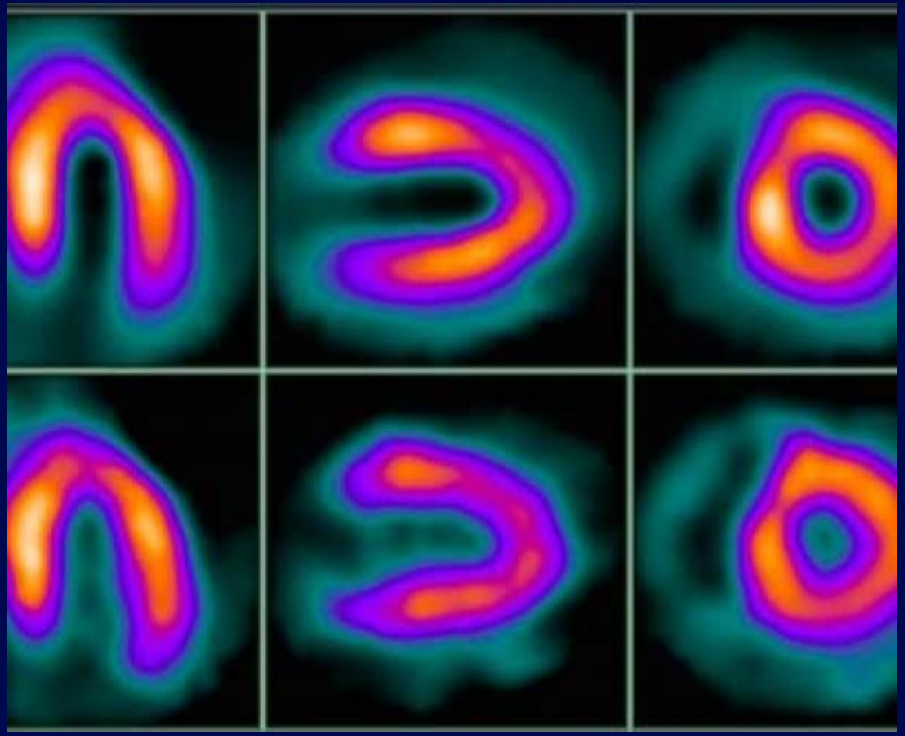
Myocardial Perfusion SPECT and its significance in cardiac imaging

•Myocardial Perfusion SPECT (Single Photon Emission Computed Tomography) is a non-invasive cardiac imaging technique.
•It involves injecting a radioactive tracer into the bloodstream, which is then taken up by the heart muscle in proportion to blood flow.
•Patients may undergo exercise or receive medications to stress the heart, followed by imaging with a specialized camera. The collected data is analyzed to create 3D images, allowing doctors to assess blood flow to the heart.
•This technique is valuable for diagnosing coronary artery disease, evaluating myocardial viability, determining risk factors, and monitoring treatment effectiveness. It aids in making informed decisions about cardiac health.

Myocardial Perfusion SPECT images
How do they look like?

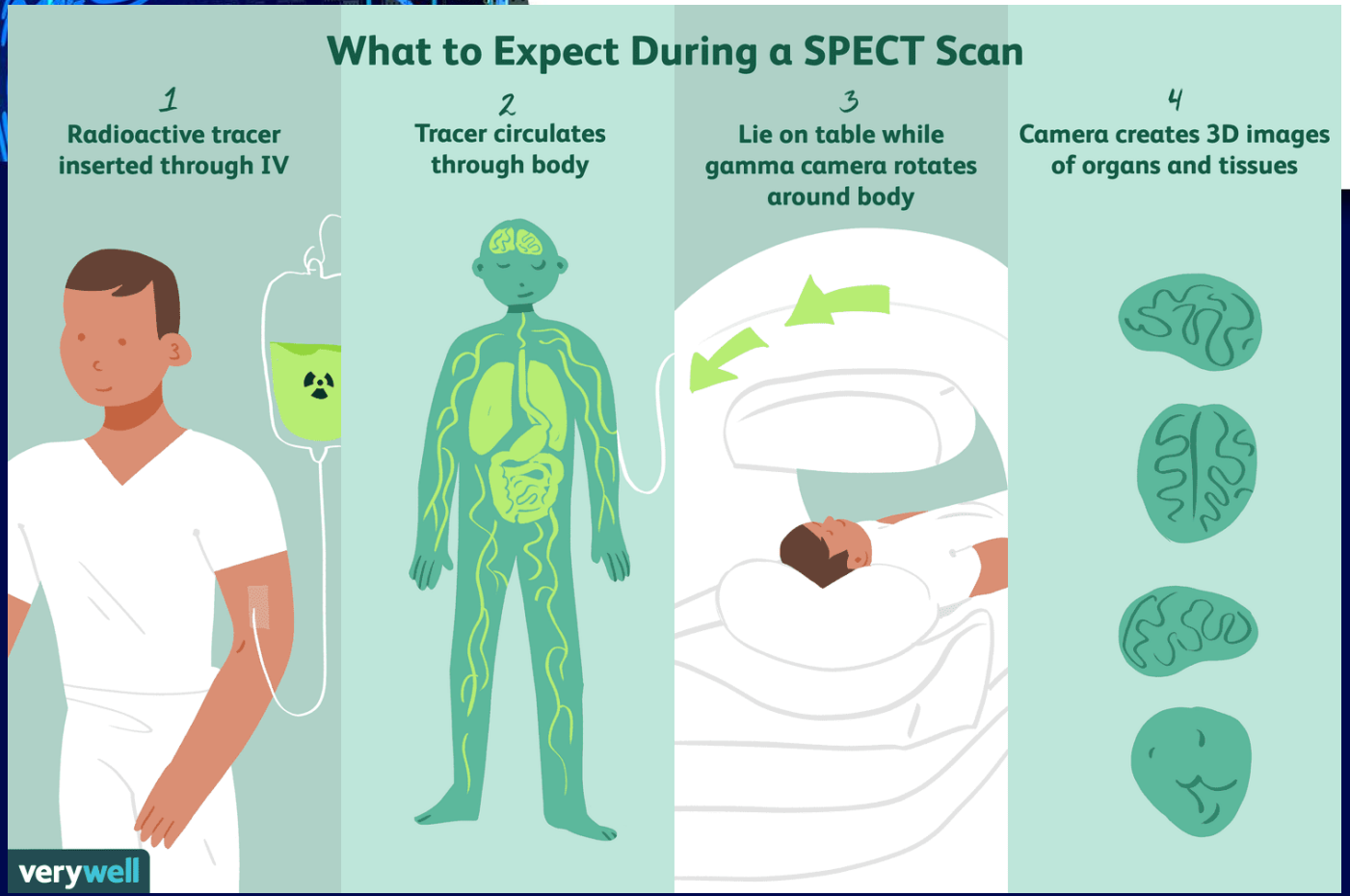


How Myocardial Perfusion SPECT helps diagnose coronary artery disease.

- Myocardial Perfusion SPECT assesses blood flow to the heart.
- It involves rest and stress imaging to detect reduced blood flow.
- Perfusion defects reveal areas with inadequate blood supply.
- Defects correlate with specific coronary artery blockages.
- It distinguishes reversible (ischemia) from irreversible defects (infarction).
- Quantitative analysis assesses CAD severity more precisely.
- Helps risk-stratify patients and guides treatment decisions.
- Provides valuable information for managing coronary artery disease.

Radioactive tracers during process

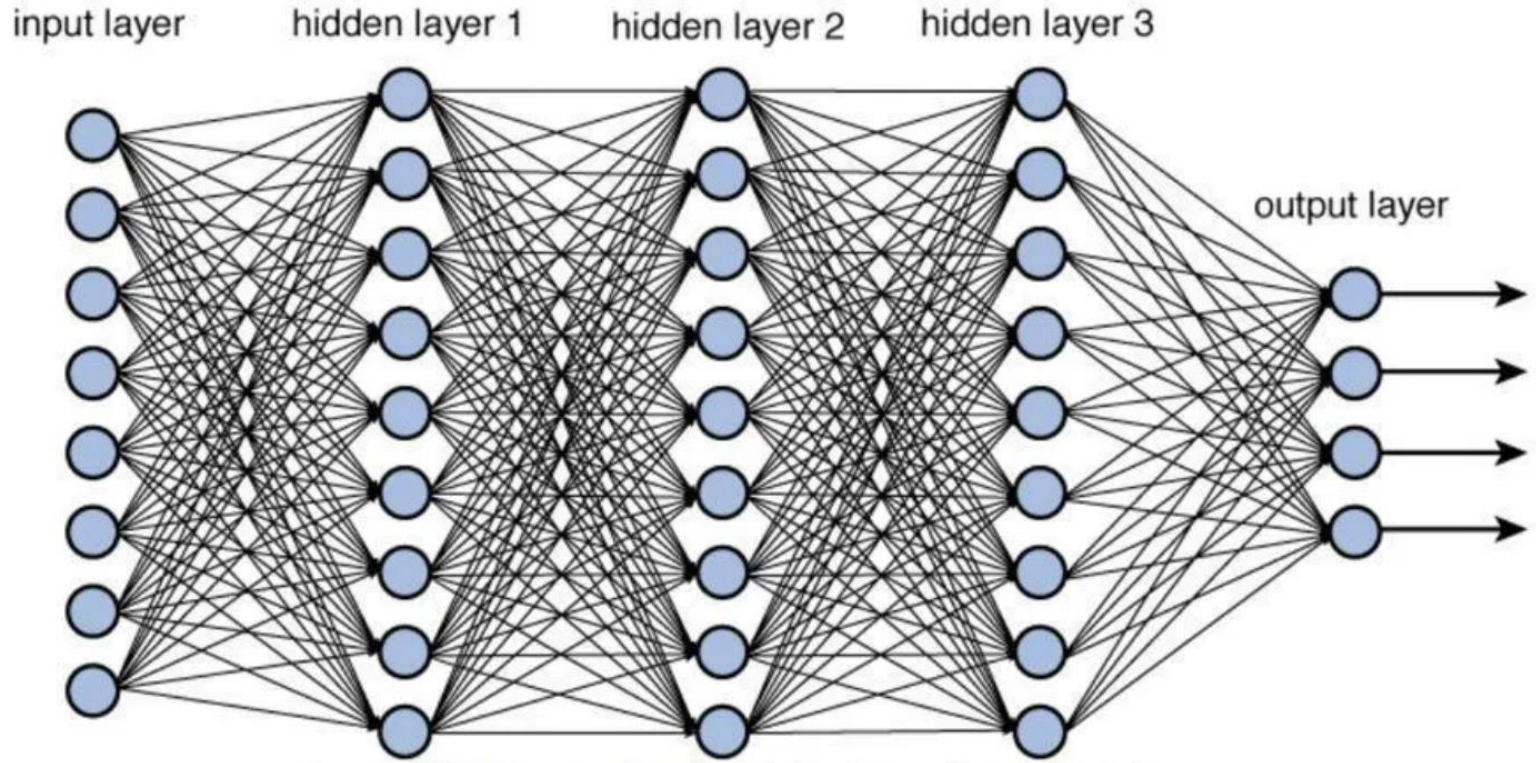
- Radioactive tracers, like Tc-99m, are used in cardiac SPECT imaging.
- Tracers are administered to the patient via injection.
- Images are taken at rest and during stress to assess blood flow.
- A gamma camera detects emitted gamma rays.
- Computer software processes images to create perfusion maps.
- Perfusion defects are identified to diagnose heart conditions.
- Results guide further tests or interventions.
- Cardiac SPECT is used for follow-up and treatment monitoring.


What to Expect During a SPECT Scan
1
Radioactive tracer inserted through IV
2
Tracer circulates through body
3
Lie on table while gamma camera rotates around body
4
Camera creates 3D images of organs and tissues
verywell

Deep Learning

- Deep Learning (DL) is a subset of artificial intelligence (AI).
- DL involves neural networks with multiple layers (deep neural networks).
- It mimics the human brain's ability to process and learn from data.
- DL excels at tasks like image and speech recognition, natural language processing.
- It learns hierarchical representations of data through layers of abstraction.
- DL has revolutionized AI by achieving remarkable accuracy in complex tasks.
- DL's role in AI continues to grow, driving advancements in various domains.

Deep Neural Network



DL in medical imaging

- DL improves medical imaging for diagnosis.
- Automates image analysis and reduces workload.
- Enables personalized treatment plans.
- Supports radiologists in image interpretation.
- Used in cardiovascular, oncology, and neuroimaging.
- Offers speed and accuracy in image analysis.
- Integrates with healthcare systems for real-time support.
- Faces challenges like dataset size and model interpretability.
- Ongoing research drives advancements in medical imaging with DL.

Enhancing Quality of Life for Cardiac Patients through Deep Learning

- Early disease detection for timely treatment.
- Reduced need for invasive tests.
- Faster and more efficient diagnoses.
- Remote monitoring to minimize clinic visits.
- Enhanced rehabilitation and recovery outcomes.
- Predictive capabilities for preventive healthcare.
- Overall, DL contributes to an improved quality of life for patients.

Research Objectives

•To investigate the application of Deep Learning (DL) algorithms in the analysis of Myocardial Perfusion Single Photon Emission Computed Tomography (SPECT) images.
•To assess the feasibility of using DL for timely and accurate diagnosis of coronary artery disease.
•To develop DL models that can classify patients into healthy and non-healthy categories based on SPECT image data.
•To evaluate the effectiveness and accuracy of DL-based diagnosis compared to traditional methods.
•To explore the potential of DL to reduce the need for invasive or time-consuming diagnostic procedures in the context of coronary artery disease diagnosis.
•To determine the impact of DL-based diagnosis on patient outcomes and quality of life.
•To contribute to the advancement of cardiovascular medicine through the application of DL in medical imaging and diagnosis.
•To lay the foundation for further research and innovation in the field of DL-assisted cardiac imaging and disease management.

Potential outcomes and their impact on cardiovascular medicine.

- Enhanced diagnostic accuracy.
- Tailored and effective treatment plans.
- Improved quality of life for patients.
- Potential cost savings in healthcare.
- Increased research interest in DL.
- Advancements in AI healthcare.
- Overall improvement in patient care in cardiovascular medicine.

THANK YOU!!