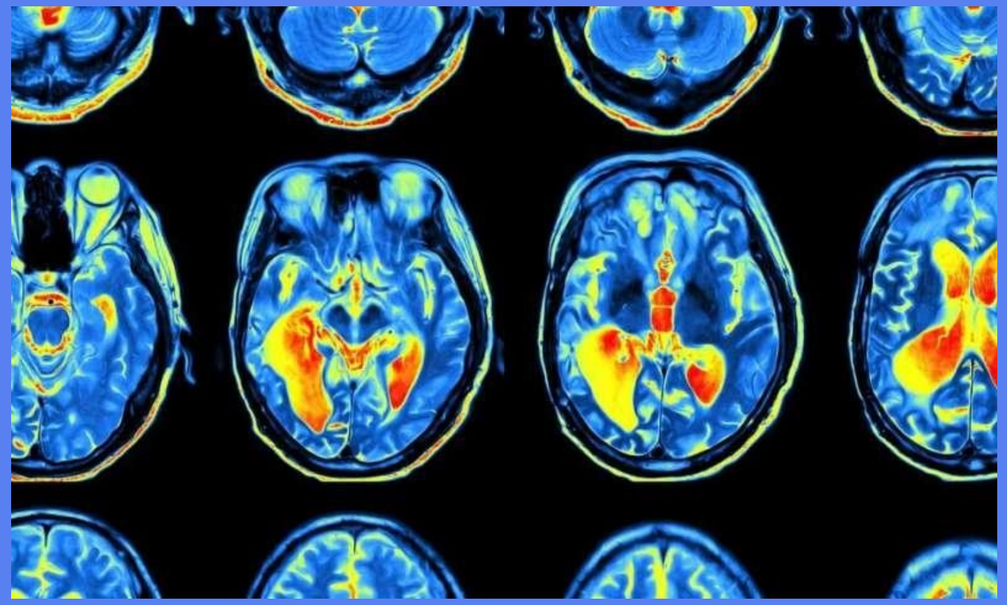
BodyScan: AI for Medical Imaging

AI-powered desktop app for precise medical image classification.

Agenda

- Introduction to BodyScan & AI's Role
- Core Technologies: Deep Learning, Flask, JavaFX
- System Architecture & Data Flow
- Disease Detection Capabilities & XAI
- Future Development & Requirements



MRI scans of the human brain, highlighting neural activity.

BodyScan: AI for Medical Imaging

BodyScan is an innovative AI-powered desktop application designed for precise medical image classification. It integrates deep learning models via Flask APIs with a user-friendly JavaFX interface.

Enhanced Precision & Analysis

Deep learning excels at identifying subtle patterns in medical images. It automates complex feature extraction, surpassing human capabilities in scale. This leads to highly accurate disease pattern recognition.

Transformative Clinical Impact

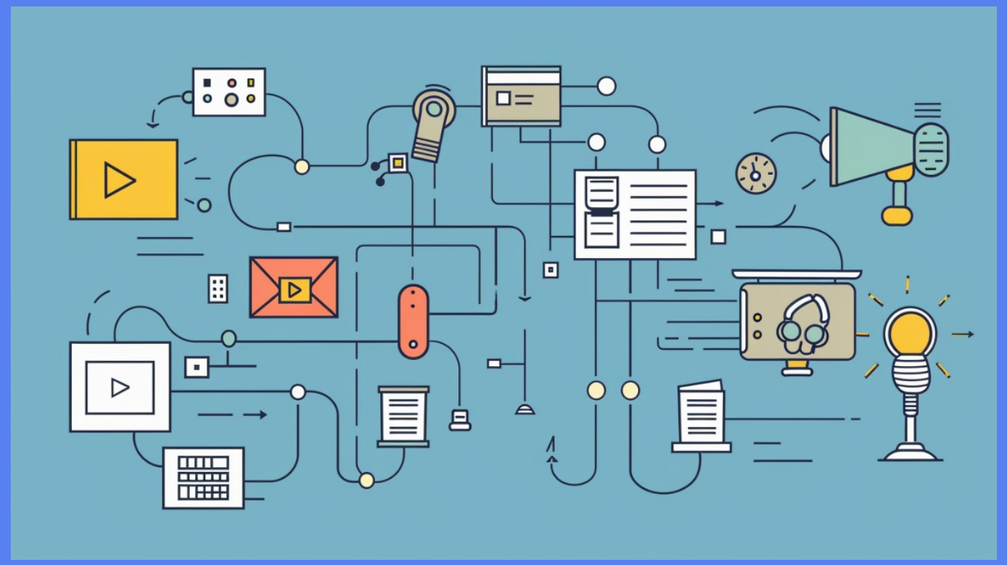
DL enables earlier disease detection, like tumor segmentation in radiology. It supports personalized treatment planning and significantly reduces diagnostic variability. Retinopathy grading is another key application.

Core Technological Components

- Deep Learning Models: CNNs for robust image classification.
- Flask APIs: Scalable backend, e.g., `/predict_chest`.
- JavaFX: Rich, cross-platform GUI with styled interfaces.

System Architecture Overview

BodyScan employs a modular architecture: a JavaFX UI communicates via HTTP/REST with a Flask API backend. This backend then interfaces with deep learning models, like for `/predict_chest`, to process medical images and return results.



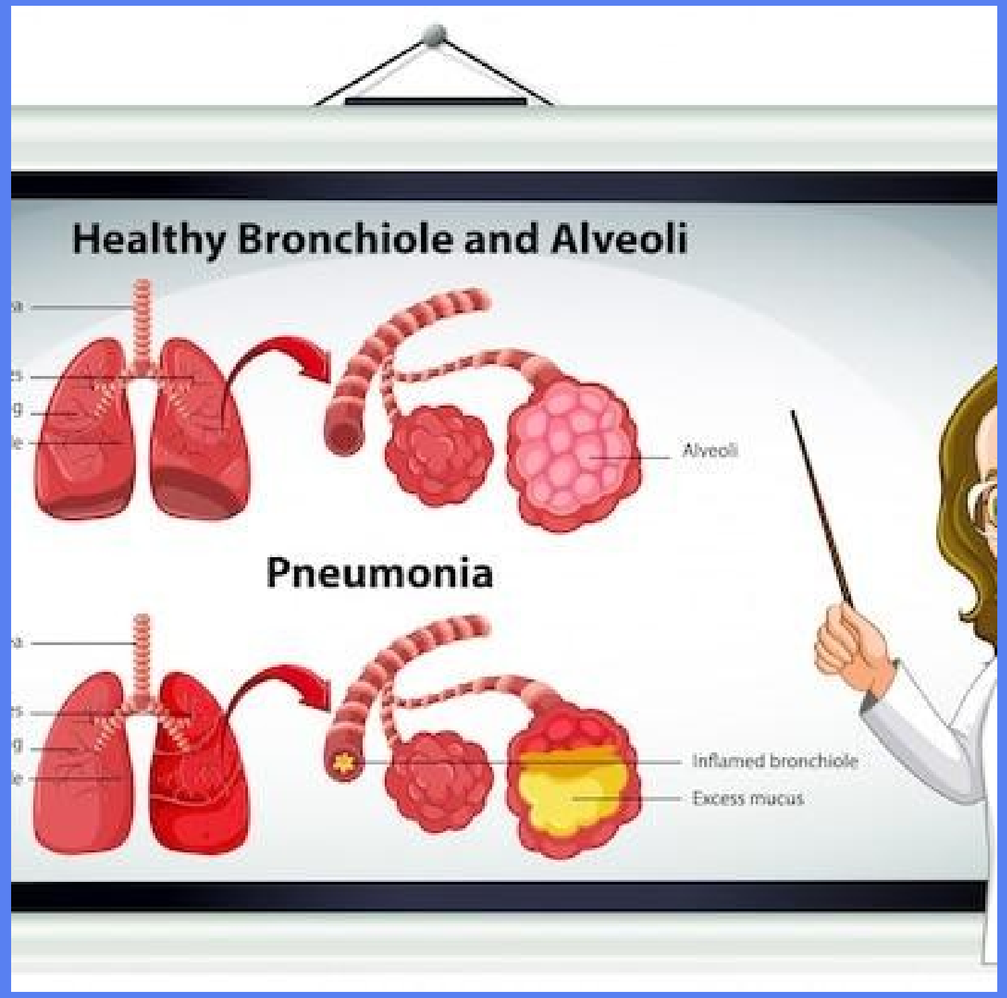
Communication process flow with various media elements.

Data Flow: User to Prediction

- User uploads image (DICOM, JPG) via JavaFX UI.
- Image sent to Flask API (e.g., `/predict_chest`).
- Model preprocesses, infers prediction (CNN).
- Flask returns JSON; JavaFX displays styled results.

Deep Learning Model Foundations

BodyScan's core uses CNNs, such as ResNet or InceptionV3, for medical image classification. These models leverage hierarchical feature extraction, learning complex patterns for precise diagnostic tasks like identifying bone fractures.



Healthy lungs versus pneumonia: a visual comparison.

Specialized Disease Detection Models

• Chest X-ray: Pneumonia, Cardiomegaly (93% accuracy)

• Diabetic Retinopathy: Mild to severe stages (90% accuracy)

• Validated on NIH ChestX-ray14 and APTOS 2019 datasets

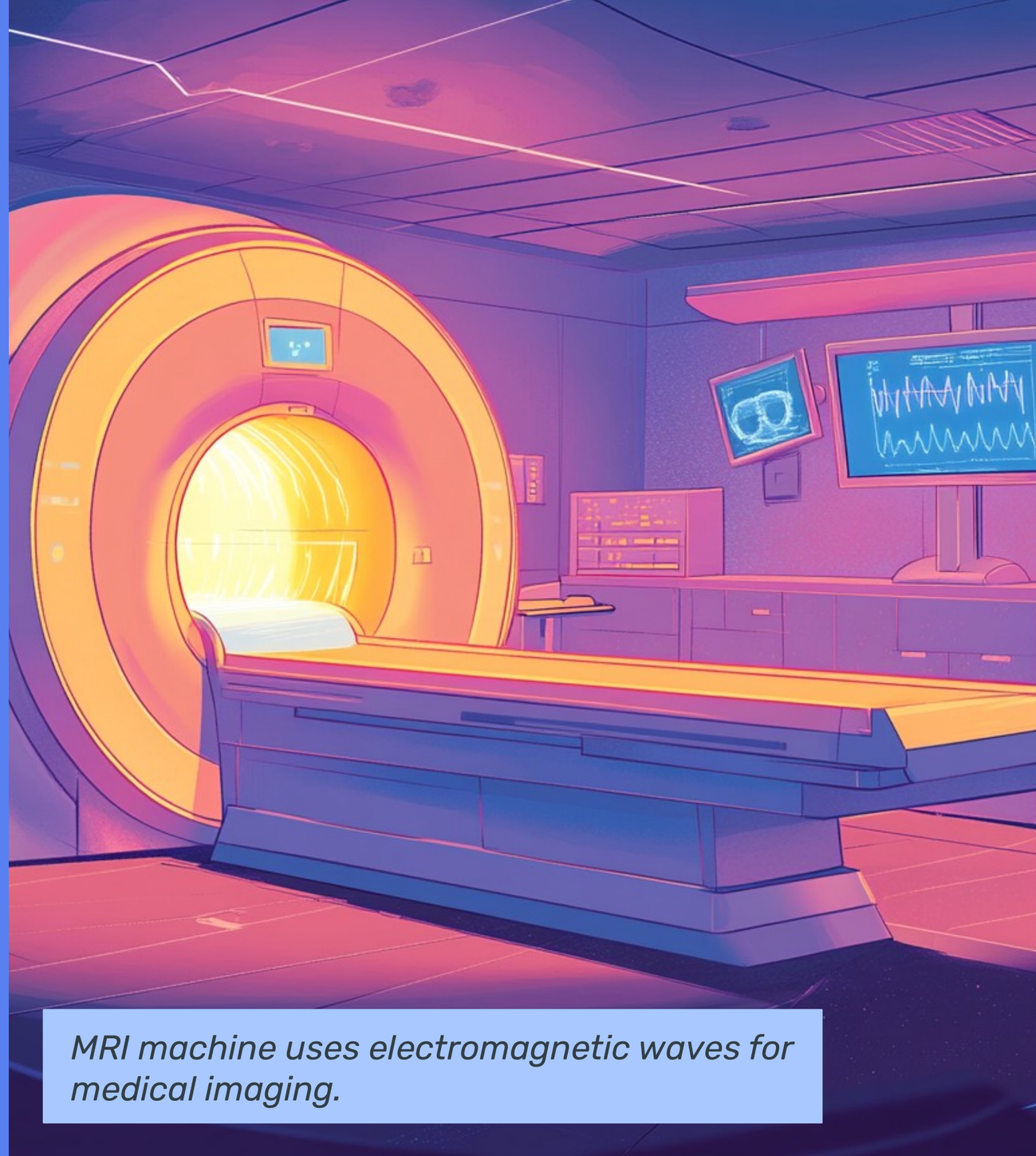
• Clinically relevant for early and accurate diagnosis

Advanced Image Analysis Capabilities

- Brain Tumor Classification: 89% on BraTS MRI.
- Identifies Glioma, Meningioma from MRI scans.
- Bone Fracture Detection: 98% accuracy on X-rays.
- Versatile across diverse anatomical regions/modalities.

Dataset Diversity & Advanced Preprocessing

Diverse datasets (e.g., CheXpert, BraTS) are vital for robust model generalization across patient populations. Advanced preprocessing, including normalization and elastic deformations, prevents overfitting and improves performance.



MRI machine uses electromagnetic waves for medical imaging.

Flask Backend: API Endpoints

- Flask: Lightweight RESTful API for models.
- Endpoints: `/predict_chest`, `/predict_brain`, etc.
- Requests: Image via multipart form-data.
- Responses: JSON (prediction, confidence score).

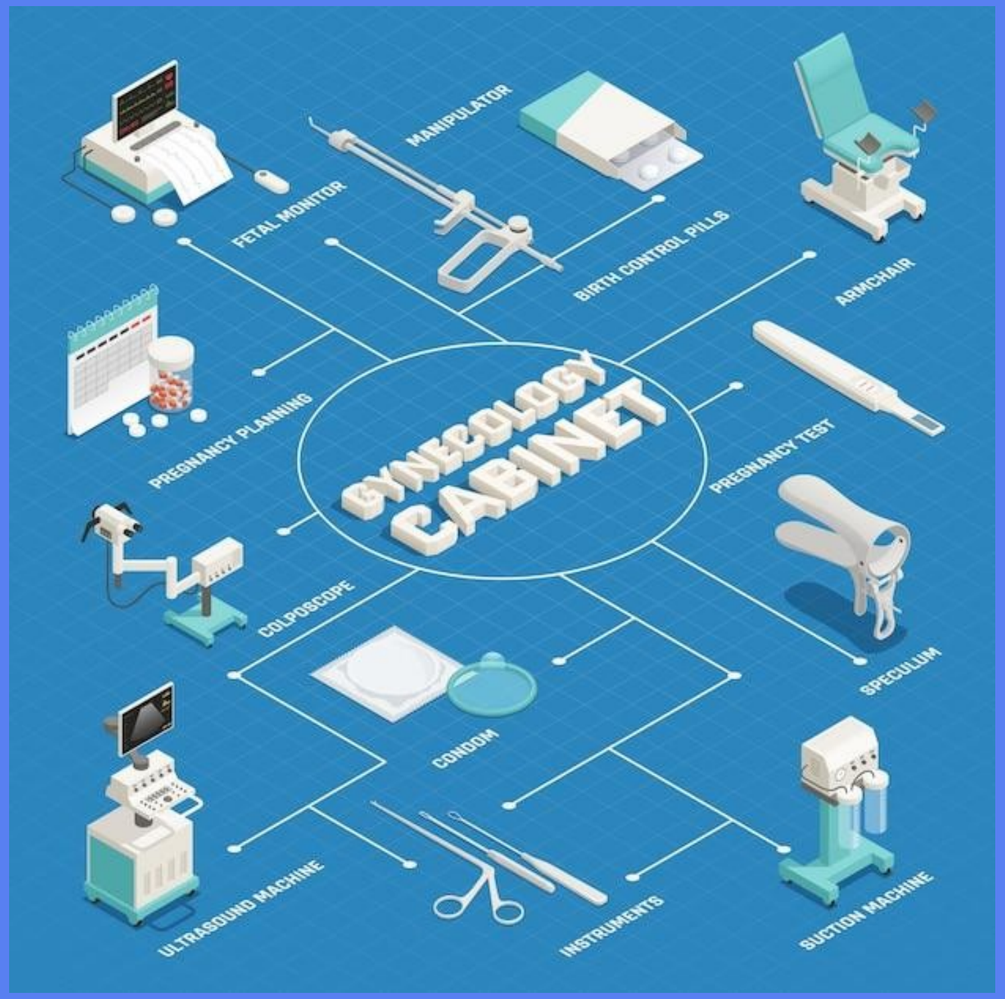
JavaFX Frontend: User Experience

The JavaFX UI provides an intuitive, responsive experience for clinicians. Features include drag-and-drop image upload, real-time progress indicators, and styled result windows displaying probability scores. Smooth transitions enhance overall clinical usability.

Modern workspace: technology and work integration for programming.

Installation Requirements

- Python 3.8+ (with pip)
- Flask 2.x, TensorFlow 2.x (or PyTorch)
- Java Development Kit (JDK) 11+, JavaFX SDK
- Virtual environments: venv or conda



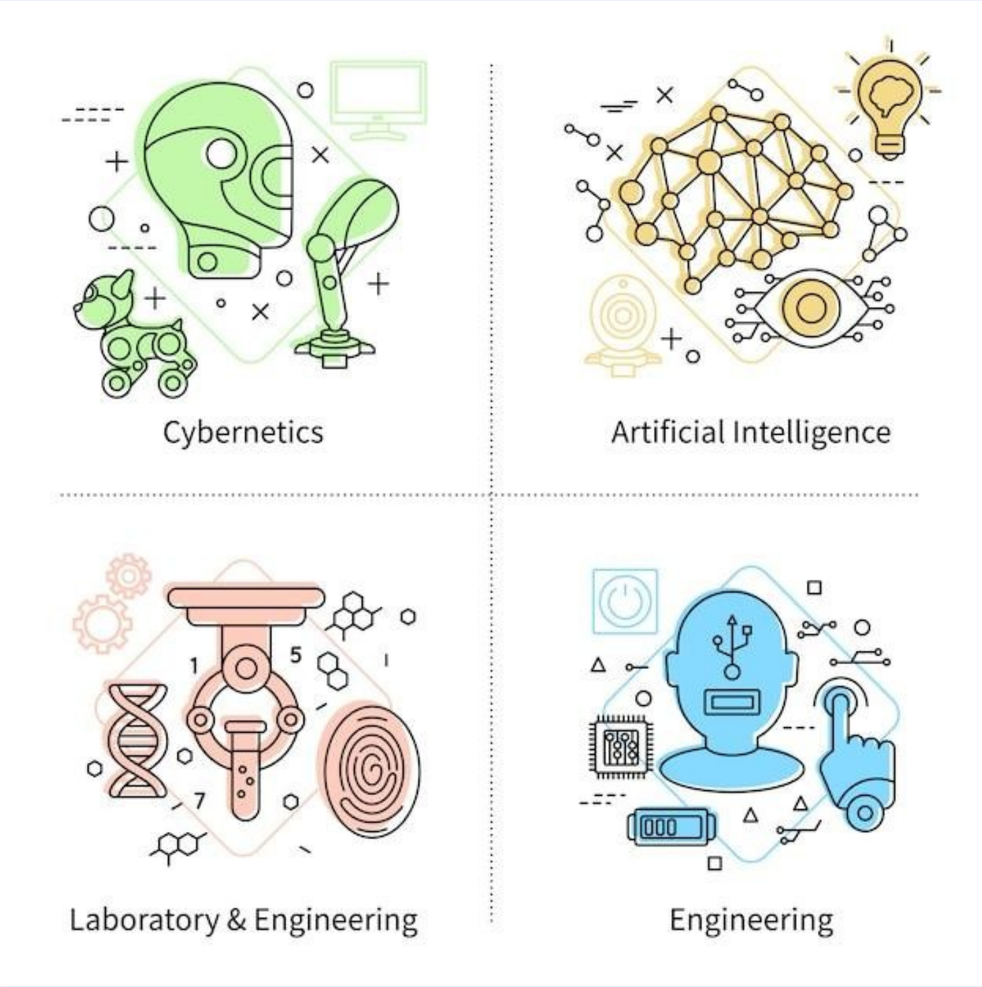
Gynecology cabinet tools and procedures: fetal monitor, birth control, ultrasound.

Application Usage Workflow

- Model & API Setup: Load pre-trained models, activate Flask APIs.
- Launch Frontend: Execute the JavaFX user interface.
- Image Submission: User uploads medical image via UI.
- Diagnostic Feedback: Interpret real-time predictions and confidence scores.

The Need for Explainable AI (XAI)

In high-stakes medical diagnosis, XAI is crucial for building trust. Techniques like Grad-CAM provide visual heatmaps, highlighting regions of interest in medical images. This aids clinicians in understanding AI predictions, aligning with current research trends.



AI and Engineering: Cybernetics, AI, Lab, and Human Intelligence.

Future Development & Expansion

- Integrate models for cancer detection, neurological disorders.
- Cloud deployment (AWS, Azure), mobile integration.
- Advanced dashboards, longitudinal tracking, EHR integration.