Imaging Fusion

Imaging fusion is the process of combining two or more medical imaging datasets—such as **MRI**, **CT**, **PET**, or **fMRI**—into a single spatially aligned view, used for better diagnostic and surgical accuracy.

Key Characteristics

- Uses software algorithms to align images from different modalities
- Can be **rigid** (bone-based) or **non-rigid** (deformable tissue modeling)
- Enhances visualization of anatomy, function, and pathology
- Essential in neuronavigation, oncology, and stereotactic surgery

⚙ Common Fusion Combinations

Modality 1	Modality 2	Purpose
MRI	CT	Combines soft tissue with bone detail for surgical planning
PET	MRI	Localizes metabolic activity within anatomical context
fMRI	MRI	Identifies functional brain areas prior to resection
CT	Intraop CT	Used in frameless stereotaxy and robotic navigation

Clinical Example

- “We fused the patient's MRI with intraoperative CT to align targets with robotic coordinates.”

Applications

- Deep Brain Stimulation (DBS)
- Tumor resection planning
- Epilepsy surgery
- Stereotactic biopsy or radiosurgery