# Product Requirements

## Primary Use Cases

- **Research demo:** Compare image-only vs. tabular-only vs. fused predictions on ovarian ultrasound.
- **Teaching tool:** Show how multimodal fusion impacts ROC-AUC and sensitivity/specificity trade-offs.
- **What-if analysis:** Adjust biomarkers (Age, CA-125, BRCA) and see probability shifts.

## User Stories

- As a researcher, I upload an ultrasound frame and enter biomarkers to get a malignancy probability and explanations.
- As an instructor, I need clear metrics and plots to illustrate fusion benefits and risks.

## Functional Requirements

- Upload image (JPG/PNG), enter Age/CA-125/BRCA, and return probability (0–1) with label.
- Persist model weights; display ROC curve and confusion matrix from latest evaluation.
- Log inputs and outputs locally for reproducibility (non-PHI only).

## Non-Functional Requirements

- **Performance:** $<$1 s inference on CPU/GPU for a single image.
- **Reliability:** Deterministic seeds; versioned model artifacts.
- **Safety:** Prominent disclaimer; no clinical use claims.

## Tech Stack Diagram (Textual)

| Component | Description |
|---|---|
| UI | Streamlit app (image upload + biomarker form) |
| Fusion Model | Keras/TensorFlow: CNN encoder + MLP encoder + concat head |
| Artifacts | `image_model.h5`, `tabular_model.h5`, `fused_model.h5` |
| Data | MMOTU images + synthetic CSV (Age, CA-125, BRCA, Label) |
| Explainability | Grad-CAM (image), SHAP (tabular features) |

## Acceptance Criteria

- App loads model and returns a probability with a clear benign/malignant label.
- Evaluation notebook outputs ROC/PR curves and confusion matrices for all models.
- Risk & bias log and model card accompany release.