Product Backlog: Apple iPhone App for Visual Classification of Bulging Pouch Battery Cells

Epic 1: Data Collection & Annotation

User Story 1.1: As a researcher, I want a large and diverse image dataset of pouch cells so that the ML model can generalize well.

- Task 1.1.1: Define image capture protocol (angles, lighting, distances).
- Task 1.1.2: Capture high-resolution images of normal & bulging pouch cells.
- Task 1.1.3: Annotate dataset using bounding boxes/classification tags.
- Task 1.1.4: QA of annotations and finalize train/validation/test splits.

Epic 2: Model Development

User Story 2.1: As a machine learning engineer, I want to train an accurate model so that the app can reliably detect bulging cells.

- Task 2.1.1: Implement image preprocessing (resizing, normalization, augmentation).
- Task 2.1.2: Train baseline CNN (MobileNet).
- Task 2.1.3: Perform hyperparameter tuning (learning rate, batch size, epochs).
- Task 2.1.4: Evaluate performance (accuracy, precision, recall).
- Task 2.1.5: Export optimized model to CoreML format.

Epic 3: iOS Application Development

User Story 3.1: As a user, I want to capture images of pouch cells with my iPhone so that I can test for bulging quickly.

- Task 3.1.1: Set up iOS project skeleton in Swift/SwiftUI.

- Task 3.1.2: Implement camera capture module.
- Task 3.1.3: Add image preprocessing pipeline in app.

User Story 3.2: As a user, I want to view real-time results in the app so that I can understand the classification instantly.

- Task 3.2.1: Integrate CoreML model into the iOS app.
- Task 3.2.2: Build inference pipeline (model input/output handling).
- Task 3.2.3: Design results display screen (normal vs bulging and confidence score).

User Story 3.3: As an enterprise user, I want optional reporting so that I can track battery health records.

- Task 3.3.1: Implement result history storage (local or cloud-based).
- Task 3.3.2: Enable export/report feature.

Epic 4: Testing & Validation

User Story 4.1: As a tester, I want to validate the app under real-world conditions so that I can ensure it works reliably.

- Task 4.1.1: Create unit tests for preprocessing pipeline.
- Task 4.1.2: Conduct functional testing of inference accuracy.
- Task 4.1.3: Perform performance benchmarking (speed, latency).
- Task 4.1.4: Pilot test app with lab/industrial samples.
- Task 4.1.5: Collect user feedback on usability & accuracy.

Epic 5: Final Integration & Reporting

User Story 5.1: As a stakeholder, I want complete project documentation so that future teams can maintain and extend the system.

- Task 5.1.1: Write technical documentation (model, workflows, etc).
- Task 5.1.2: Write user guide for app usage.
- Task 5.1.3: Prepare validation report (field testing results).

User Story 5.2: As a senior design team, we want to present our project effectively so that we can demonstrate its impact.

- Task 5.2.1: Prepare final presentation slides & demo video.
- Task 5.2.2: Conduct final team rehearsal.
- Task 5.2.3: Deliver final submission.