**Sprint-4**

**Introduction**

In this Sprint, the purpose was to add Crew AI agent decision making functionality and then add integration tests and validation of code and finally backtest the strategy. The following sections contain the user stories I worked on with a detailed description of the tasks I worked on.

**User Stories**

I worked on the following User Stories:

[**NQR: Fundamental ML Pipeline (FNN / RF / ANFIS) for Next-Quarter Return Prediction #597**](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/597)

**Conditions of Satisfiability:**

* Data Integrity: No missing or malformed ratio inputs; NaNs handled.
* Model Validity: All three models accept the same input shape and produce probabilities in [0, 1].
* Performance: Full inference (load + predict) runs ≤ 1 s on Codespaces CPU.
* Robustness: Pipeline tolerates new tickers or missing quarters without crashing.
* Integration: DecisionAgent always returns BUY or SELL (no HOLD).

**Definition of Done:**

* Ratio fetching and storage scripts implemented and unit-tested.
* FNN, RF, and ANFIS model code written, trained, and validated.
* Inference endpoint loads all three models and emits correct JSON.
* Crew AI decision agent defined and tested end-to-end.
* Integration tests and documentation (README, examples) completed.
* Backtesting harness implemented and performance report generated.

**Tasks**

[NQR.1 Ratio Data Retrieval & Preparation #598](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/598)

[TRF.1.1: Fetch OHLCV data for target tickers via yfinance (4 ph). #722](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/722)

[TRF.1.2: Impute missing data and align timestamps (4 ph). #723](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/723)

[TRF.1.3: Normalize features using z-score (4 ph). #724](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/724)

[TRF.1.4: Slice data into 20-day windows with train/validation/test splits (8 ph). #725](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/725)

[NQR.2 Model Training Pipeline #629](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/629)

[NQR.2.1 Define FNN architecture and training loop (3 ph) #692](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/692)

[NQR.2.2 Train and validate FNN; log accuracy (2 ph) #693](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/693)

[NQR.2.3 Train Random Forest with hyperparameter tuning (2 ph) #694](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/694)

[NQR.2.4 Train ANFIS model and verify convergence (3 ph) #695](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/695)

[NQR.2.5 Compare validation metrics and select thresholds (1 ph) #696](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/696)

[NQR.3 Inference API Development #697](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/697)

[NQR.3.1 Create ModelInferAgent script to load all three models (2 ph) #698](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/698)

[NQR.3.2 Given input ratios, compute and format { fnn\_prob, rf\_prob, anfis\_prob } JSON (1 ph) #699](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/699)

[NQR.3.3 Benchmark inference latency and optimize if >1 s (1 ph) #700](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/700)

[NQR.4 Crew AI Decision Agent #701](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/701)

[NQR.4.1 Define Crew AI prompt logic for majority-vote or threshold rules (2 ph) #702](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/702)

[NQR.4.2 Implement and test DecisionAgent with edge-case probabilities (1 ph) #703](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/703)

[NQR.5 Integration & Testing #704](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/704)

[NQR.5.1 Write end-to-end integration test: fetch → ratios → infer → decision (2 ph) #705](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/705)

[NQR.5.2 Validate outputs for a sample ticker set (1 ph) #706](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/706)

[NQR.5.3 Document pipeline, usage examples, and agent prompts in README (2 ph) #707](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/707)

[NQR.6 Backtesting & Evaluation #708](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/708)

[NQR.6.1 Prepare historical test sets and data conversion (2 ph) #709](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/709)

[NQR.6.2 Implement backtesting harness to simulate the full infer → decision pipeline over history (3 ph) #710](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/710)

[NQR.6.3 Calculate backtesting performance metrics (accuracy, return, drawdown) and analysis (2 ph) #711](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/711)

[NQR.6.4 Generate backtesting report and visualizations (2 ph) #712](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/712)

**Tasks I Worked On**

[NQR.4 Crew AI Decision Agent](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/701)

I have defined Crew AI agent functionality and implemented the DecisionAgent with edge case probabilites. I have been working on this task since sprint 3 and in this sprint I have worked on this task for 8 person hours to complete.

[NQR.5 Integration & Testing](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/704)

I have developed code for integration tests and also validated the whole pipeline. The task was estimated at 5 person hours but it took me 10 hours to complete.

[NQR.6 Backtesting & Evaluation](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/708)

I have backtested the strategy using backtrader and I have been able to generate the performance metrics. The task was estimated at 9 person hours but it took me 18 hours to complete.

**Summary Table of Work**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| UserStory GitHub Issue ID | User Story | Story Points | Task GitHub Issue ID | Task | Task Hours | Status | Actual Hours |
| [NQR](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/597) | [Fundamental ML Pipeline (FNN / RF / ANFIS) for Next-Quarter Return Prediction #597](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/597) |  | [[NQR.4](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/629)](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/701) | [Crew AI Decision Agent](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/701) | 3 | Updated the code and Completed | 8 hours (sprint 4) |
| [NQR](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/597) | [Fundamental ML Pipeline (FNN / RF / ANFIS) for Next-Quarter Return Prediction #597](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/597) |  | [NQR.5](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/704) | [Integration & Testing](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/704) | 5 | Completed | 10 |
| [NQR](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/597) | [Fundamental ML Pipeline (FNN / RF / ANFIS) for Next-Quarter Return Prediction #597](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/597) |  | [NQR.6](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/708) | [Backtesting & Evaluation](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/708) | 9 | Completed | 18 |

**Summary Table of Commits**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date | Commit Number | Commit Description (exactly as in github) | User Story | Task |
| August 8th, 2025 | 9a3c0bba6d803c24f87376836515564bf3e2400c | [Updated Crew AI code](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/pull/782/commits/9a3c0bba6d803c24f87376836515564bf3e2400c) | [NQR](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/597) | [NQR.4](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/701) |
| August 8th, 2025 | ea819030a32c99e8b2a89755d39d805030850c95 | [NQR Backtesting code added](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/pull/782/commits/ea819030a32c99e8b2a89755d39d805030850c95) | [NQR](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/597) | [NQR.5](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/704)  [NQR.6](https://github.com/Rivier-Computer-Science/AI-Agent-Stock-Prediction/issues/708) |