



Ahmedabad
University

CSE623: Machine Learning Theory and Practice

Report-7

Group 1

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Work Done

Firstly, we defined a **custom environment class** `LineupEnv` to simulate lineup building:

- Maintains a list of available players and current lineup.
- Uses opposition lineup as fixed input.
- Calculates team and opponent stats dynamically as players are added or removed.
- Allows actions to **add or remove a player**.
- Limits the lineup to **5 players maximum**.
- Computes a **reward only when the lineup is complete**, based on win probability predicted by a logistic regression model.

Developed the **Q-Learning algorithm**:

- Initializes a Q-table to store values for each (state, action) pair.
- Repeats simulation over **1000 episodes**.
- Uses **ϵ -greedy policy** for action selection:
 - With probability ϵ , selects a random action (exploration).
 - Otherwise, selects the best-known action (exploitation).
- Updates Q-values using the Bellman equation:

$$Q(s, a) = (1 - \alpha) \cdot Q(s, a) + \alpha \cdot (r + \gamma \cdot \max_a Q(s', a))$$

where:

- α = learning rate
- γ = discount factor
- r = reward
- s, s' = current and next state

- $a = \text{action}$

- After training:
 - Starts from an empty lineup.
 - Chooses the best action at each step based on learned Q-values.
 - Builds the **optimal lineup**.
- Finally, outputs:
 - The **best 5-player lineup**.
 - The **predicted win probability** for that lineup.

```
opp_lineup = ['Alyssa Geary', 'A\'Jah Davis', 'A\'Riana Gray', 'Player4', 'Player5'] # Example opposition lineup
```

```
Logistic Regression Model Accuracy: 0.9242  
Best Lineup: ['Aaliyah Gayles', 'Aaliyah Frazier', 'A\'Riana Gray', 'A\'Jah Davis', 'A\'Moni Waiters']  
Predicted Win Probability: 0.5376
```