1 High Level Pitch

Baseball is a game of numbers. There are two dozen statistics that are tracked for pitchers alone, and that's only one position. This app intends to take the world of stats and revolutionise it with artificial intelligence and machine learning, and take baseball stats into the next era, starting at the little league level.

2 Specs

The app, as it were, has 8 core requirements.

2.1 Stat Tracking

All stats need to be tracked. Both offensive, defensive and pitching stats need to be tracked. The idea of tracking a run-differential can be neglected, because this isn't a by-the-league scenario, but rather a by-the-team scenario. **A full list of tracked stats is at the end of this document.**

2.2 Multiple User Management

A team would purchase a subscription to this application, and would get 6 accounts, one for the owner or head manager and 5 additional accounts for them to divvy out amongst their trusted staff. Each head manager would be able to manage 3 teams with one subscription, and tiers can be decided later.

2.3 Roster Management

The manager would be able to generate rosters, and maintain say 5 rosters at once. They could choose any one of these and set it for the day and print it out.

2.4 Visualisation

The manager would be able to visualise team statistics and see things by the team level.

2.5 Pitchers

Pitchers get a little extra love in this app, with them tracking all the relevant stats for them, as well as more information on individual pitch information, such as spin rate, min, max, and average velocities, K's, BB's etc.

2.6 Left Right Split

Offensive stats must be tracked and *split* about the LHP and RHP divide.

2.7 Powered Rosters

We will harness machine learning, other AI, or a custom algorithm to essentially allow the manager to generate a roster for them, based on the player's performance.

2.8 Opposing Pitcher Metrics

We will have a way to generate rosters based on how well hitters do against an opposing player's matchup.

3 AI

The AI decision making for various states are included below:

3.1 Roster Generation

Roster Generation can be done manually (of course) or a computed "best roster" can be algorithmically found by an agent under our employ. This agent will handle all of the complex computations of this nature and will easily find the "best" roster given an appropriate heuristic.

3.1.1 Heuristic: Unweighted Aggregated Worth

The best way to easily establish the "worth" of a player is to aggregate all of the deviations from the target across all stats, and then take the average of them to obtain what I am referring to as the Unweighted Aggregated Worth ($\mathcal{U}$, UAW). That is, more formally:

$$\mathcal{U} = \frac{\sum(T_i + A_i)}{2i} \text{ for } i \text{ stats where } T, A >= 1.0 \tag{1}$$

For example, suppose we have someone who's batting average is .325 and who's walk average is 3% with a target of .300 BA and 2% BB average. This leads us to compute this players UAW as

$$\frac{300 + 325 + 2 + 3}{2(2)} = 157.5$$

While a player with a a .270 BA and a 6% walk average's UAW is

$$\frac{(300 + 270 + 2 + 6}{2(2)} = 144.5$$

Since Player A's $\mathcal{U}$ is higher, we would chose Player A with more urgency.

3.1.2 Algorithm: Roster Generation (UAW)

Algorithm 1 Roster Selection Using Unweighted Aggregated Worth

Require: P to be some player
Ensure: Player P has a non-null stat spread
Calculate $\mathcal{U}$ for each player, taking all measured stats to be used in the calculation.
Take the maximum 9 of all the aggregated $\mathcal{U}$ values calculated to be a given roster.

4 Standard Baseball Stats

4.1 Defensive Stats

- Assists (A)
- Caught Stealing Percent (CS%)
- Double Play (DP)
- Errors (E)
- Fielding Percentage (FPCT)
- Innings Played (INN)
- Outs (O)
- Outfield Assists (OFA)
- Passed Balls (PB)
- Putouts (PO)
- Total Chances (TC)
- Triple Plays (TP)

4.2 Offensive Stats

- At Bats (AB)
- Batting Average (AVG)
- Caught Stealing (CS)
- Doubles (2B)
- Extra Base Hit (XBH)
- Games Played (G)
- Grand Slams (GSH)
- Ground into double play (GIDP)
- Ground Out / Air Out (GO/AO)
- Hit By Pitch (HBP)
- Hits (H)
- Home Runs (HR)
- Intentional Walks (IBB)
- Left On Base (LOB)
- On Base Percentage (OBP)
- On Base Plus Slugging (OPS)
- Plate Appearances (PA)
- Reached On Error (ROE)
- Runs (R)
- Runs Batted In (RBI)
- Sacrifice Bunt (SH)
- Sacrifice Fly (SF)
- Single (1B)
- Slugging Percentage (SLG)
- Stolen Bases (SB)
- Total Bases (TB)
- Triples (3B)
- Walks (BB)
- Walk Offs (WO)

4.3 Pitching

- Appearances (App)
- Balks (BK)
- Batters Faces (BF)
- Blown Saves (BS)
- Complete Games (CG)
- Earned Runs (ER)
- Earned Run Average (ERA)
- Flyout
- Games Finished (GF)
- Games Started (GS)
- Groundouts
- Holds (H)
- Inherited Runners (IR)
- Innings Pitched (IP)
- Losses (L)
- Number of Pitches (NP)
- Pickoffs (PK)
- Quality Starts (QS)
- Relief Wins (RW)
- Saves (SV)
- Save Opportunities (SVO)
- Save Percentage (SV%)
- Shutouts (SHO)
- Strikouts (SO, K)
- Unearned Run (UER)
- Walks and Hits Per Inning Pitched (WHIP)
- Wild Pitches (WP)
- Wins (W)
- Winning Percentage (WPCT)