Executive Summary

Quantifying “Killer Instinct” in IPL Death Overs using Bayesian Framework

Objective:

To evaluate the “mental strength” or **Killer Instinct** of bowlers in IPL Death Overs using a ball-by-ball dataset. Specifically, we aimed to measure how bowlers capitalize on pressure (dot balls) to take wickets.

Dataset:

- 4800 deliveries from 2 bowlers over multiple T20 leagues.
- Key features: Match_ID, Phase, Over, Ball, Bowler, Pitch_Type, Batter_Avg, Runs_Conceded, Is_Wicket.
- Preprocessing included sorting, duplicate removal, and feature engineering for **pressure**.

Methodology:

1. Feature Engineering (“Mental Proxy”)
    - Created a **Dot Ball feature**
    - Created **Previous Ball Dot** within each over
    - Created **Pressure feature** (Death Overs only)

Pressure = 1 if the previous ball in Death Overs was a dot ball, otherwise 0.

2. Encoding Categorical Variables:
    - Pitch_Type and Bowler were one-hot encoded to use in the Bayesian model.
3. Bayesian Logistic Regression (PyMC):
    - **Target:** Is_Wicket (1 = wicket, 0 = no wicket).
    - **Predictors:** Pressure, Pitch_Type, Batter_Avg.
    - **Priors:** Weak Normal(0, 10) for intercept and coefficients.
    - **Goal:** Estimate the effect of pressure on the probability of taking a wicket while controlling for pitch and batsman quality.

Results:

Bowler	Pressure Effect (Posterior Mean)	94% HDI	Interpretation
A	0.619	[0.537,0.712]	Moderate effect under pressure
B	1.061	[0.948,1.174]	Strong effect under pressure

Interpretation:

Bowler B has a significantly higher probability of taking a wicket after a dot ball compared to Bowler A. This confirms that **"Killer Instinct" exists** and is measurable using our Bayesian model.

Conclusion:

- Bowler B demonstrates significantly higher **mental strength under pressure** in Death Overs.
- Bayesian analysis quantitatively proves that mental resilience can be measured using ball-level cricket data.
- **Recommendation:** Select **Bowler B** for Death Overs.

Business Impact:

- Enhances data-driven decision-making for auctions and match strategies.
- Quantifies previously intangible traits such as mental resilience and the ability to capitalize under pressure.

Tools & Libraries:

Python (pandas, PyMC, Arviz, Matplotlib)