Beyond Surveys: Real-Time User Satisfaction Prediction with LLMs and Telemetry

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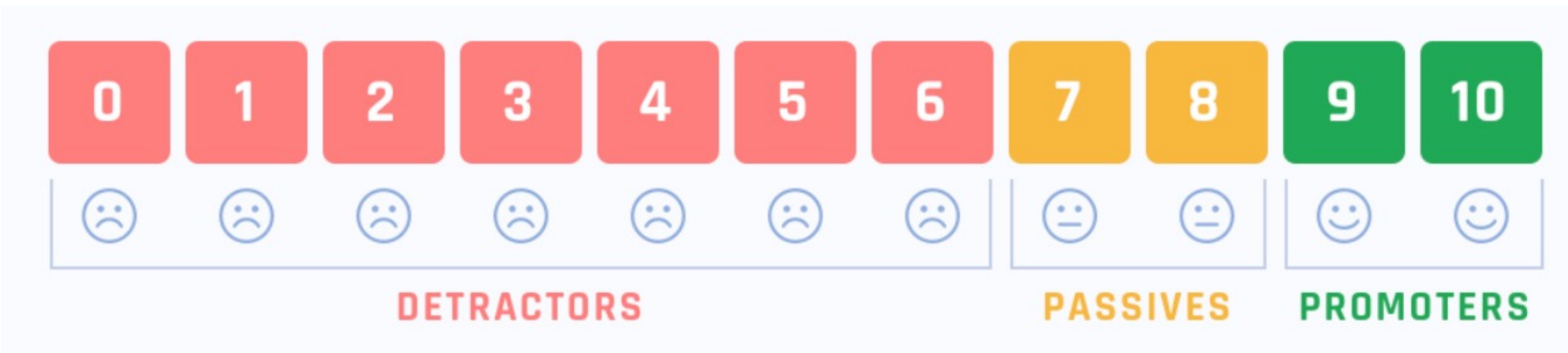
What is Net Promoter Score (NPS)?

- Industry-standard metric for measuring customer loyalty
- One simple question: *“How likely are you to recommend us?”*
- 0–10 rating → Detractors, Passives, Promoters



How NPS is calculated?

-100 to 0: POOR

- More Detractors than Promoters.
- Brand reputation is at risk.

1 to 30: GOOD

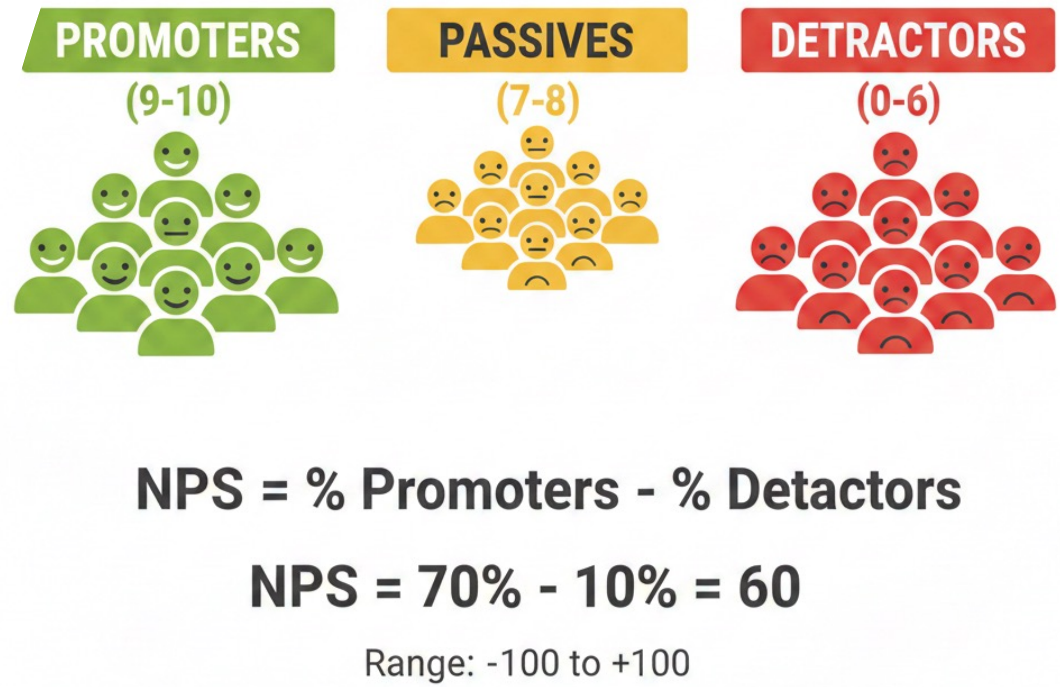
- Solid foundation.
- Focus on converting Passives to Promoters.

31 to 70: GREAT

- Strong customer loyalty.
- Your brand is a market leader.

71 to 100: WORLD-CLASS

- Customers are your primary marketing engine.



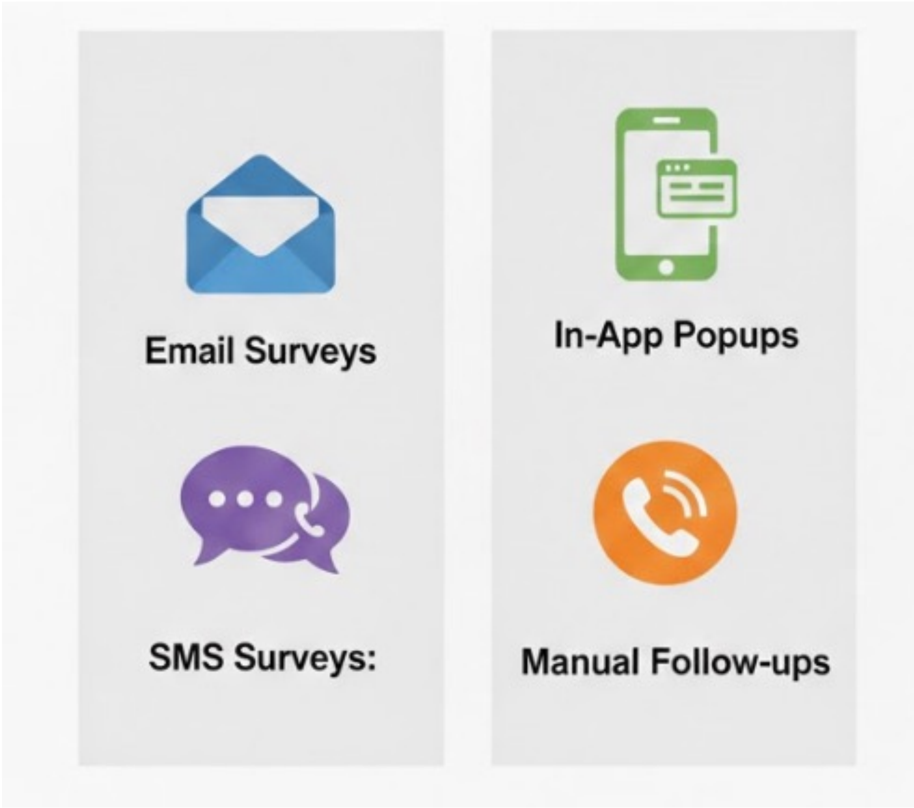
How Companies Collect NPS Today

Email Surveys
The Industry Standard

In-App Popups
Real-Time Engagement.

SMS Surveys
High-Speed Response.

Manual Follow-ups White-Glove Service.

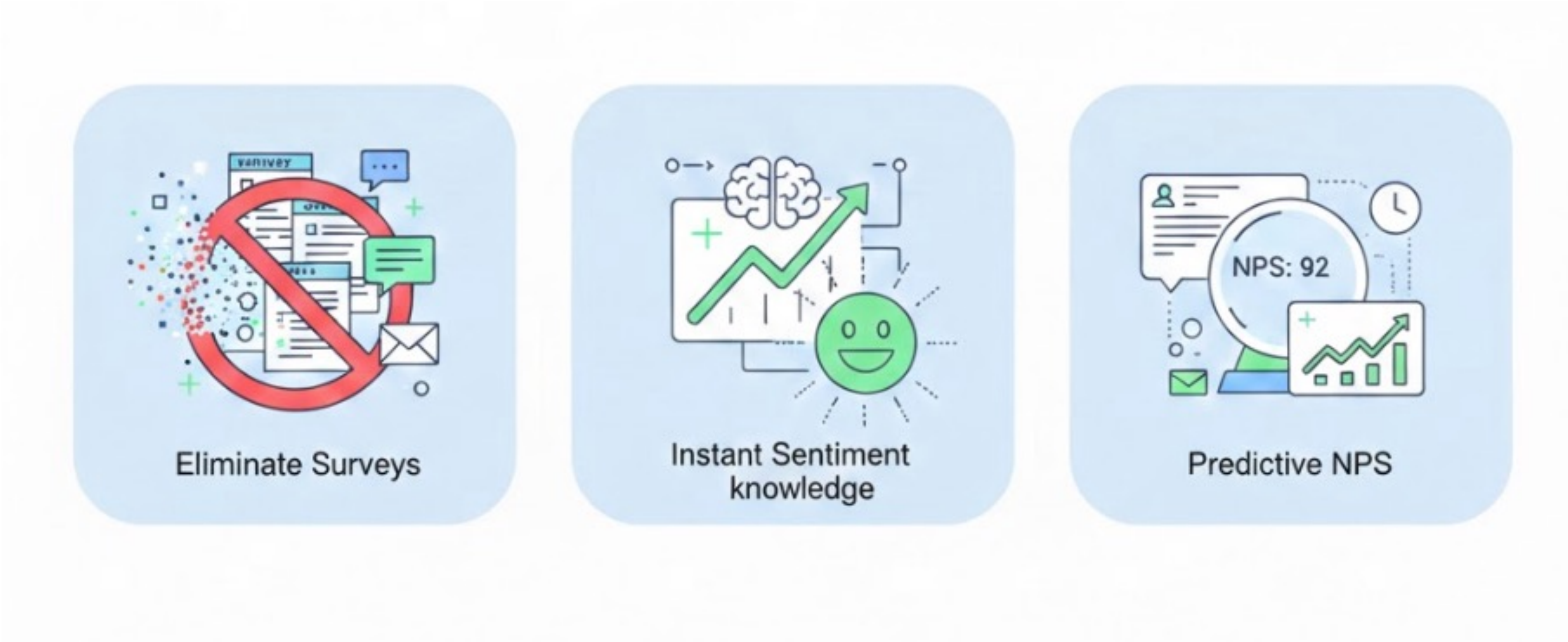


The Industry Problem

- **The Participation Gap:** Response rates are stuck between **1–5%**. Most users are "silent."
- **The Speed Barrier:** Data is often **stale**. Insights arrive days or weeks after the interaction.
- **Extreme Bias:** Only the "vocal minority" respond—the extremely happy or the very angry.
- **Reactive, Not Proactive:** By the time you see the score, you've already missed the window to fix the issue.

The Opportunity

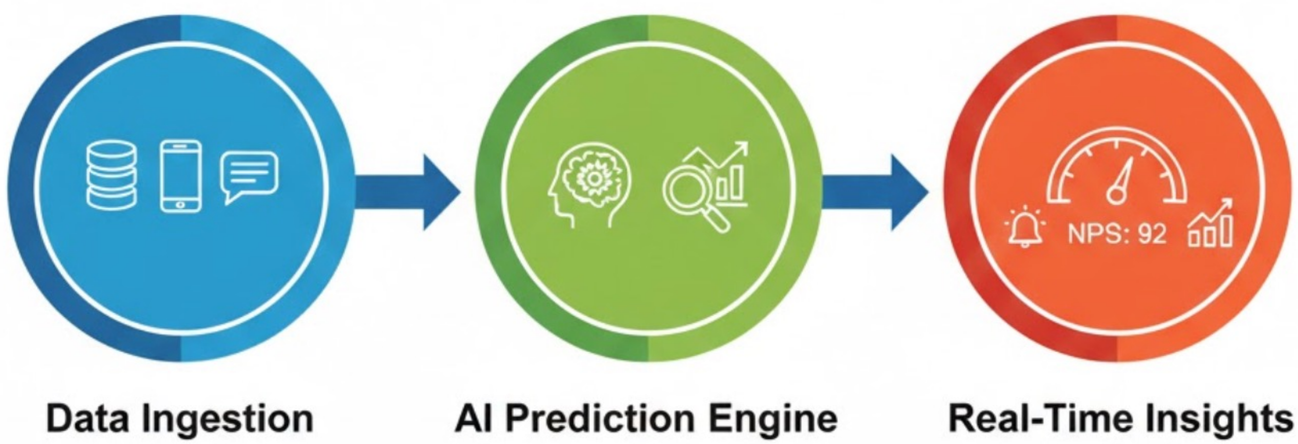
What if we could eliminate surveys?
What if we could know user sentiment instantly?
What if we could predict NPS?



Introducing DNPS:
Dynamic Net
Promoter Score

AI model that predicts user sentiment using:

- Telemetry
- Behavioral analytics
- Session patterns
- Machine learning

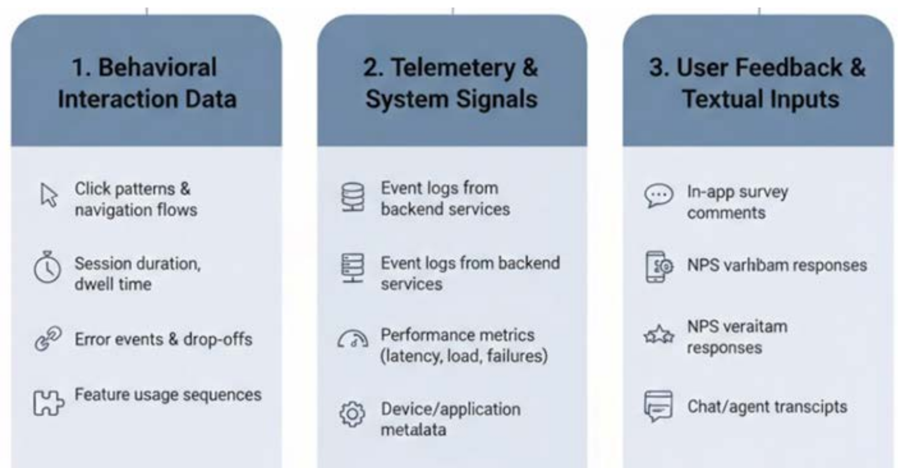


Data Collection

- **Behavioral Interaction Data**
what users are doing and how they behave during a session

- **Telemetry & System Signals**
how the system is performing while the user is interacting with it.

- **User Feedback & Textual Inputs**
how users feel and what they’re saying in their own words.



Data Processing

- **Data Cleaning**

Removes noise, duplicates, and incomplete records.

- **Normalization & Structuring**

Converts raw inputs into consistent, usable formats.

- **Timestamp Alignment**

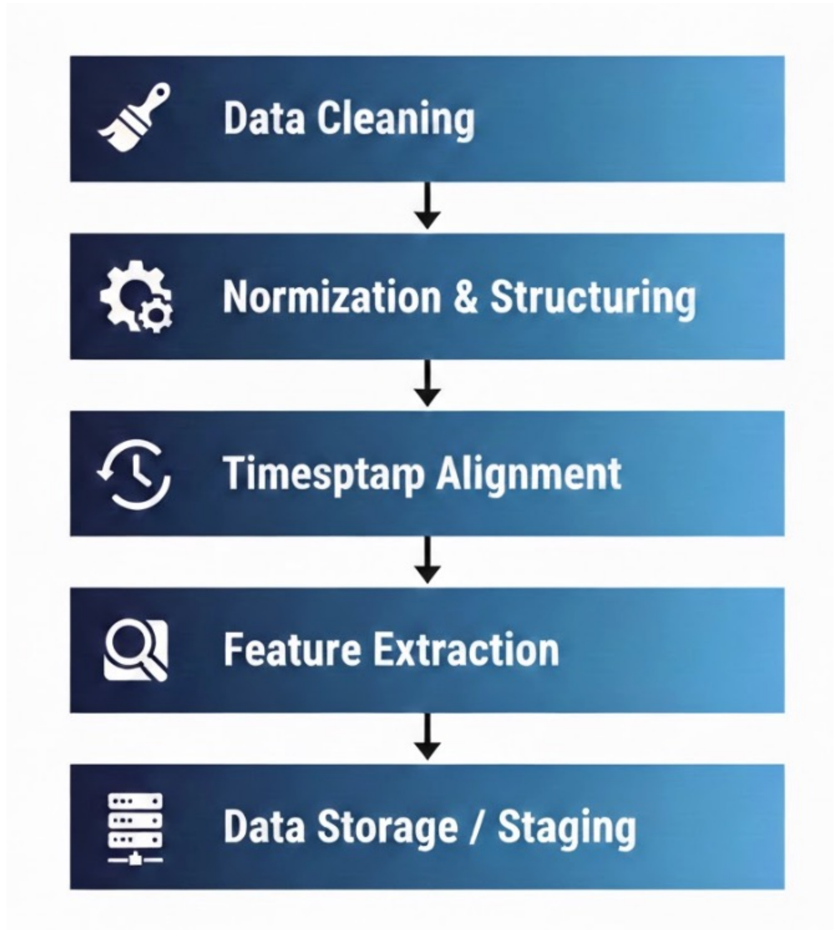
Lines up events from different sources in the correct order.

- **Feature Extraction**

Pulls key signals like patterns, metrics, and text embeddings.

- **Data Storage / Staging**

Holds processed data for model training and real-time scoring.



Hybrid AI Modeling - Overview

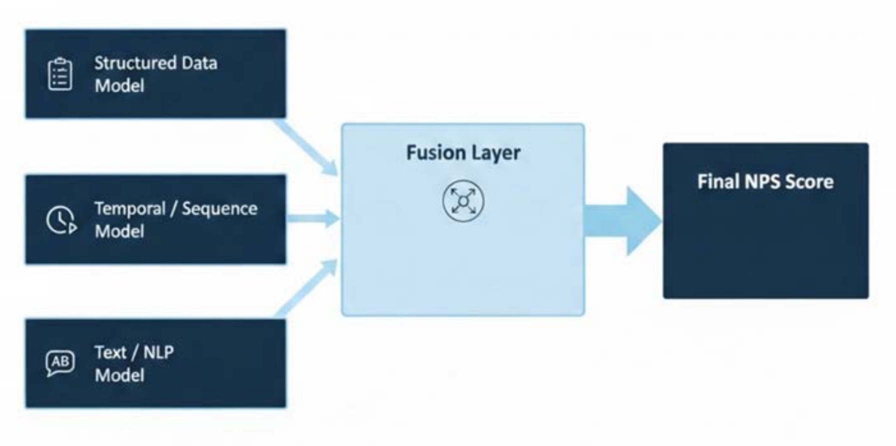
Combines multiple AI models to predict dynamic NPS scores by leveraging all types of input data

Multi-model approach ensures high accuracy

Handles different data types: structured metrics, behavioral sequences, and text feedback

Fusion produces a single, robust prediction

Supports explainability: each input's contribution can be analyzed

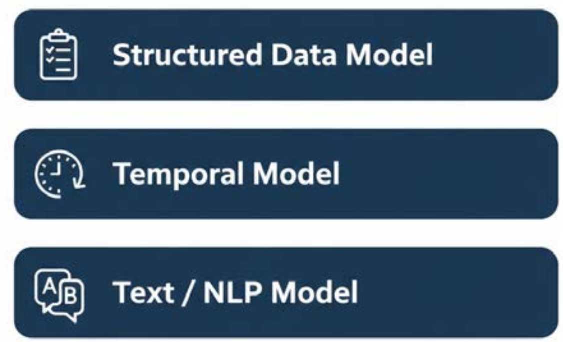


Hybrid AI Modeling - Model Details

Structured Data Model
Uses numerical and categorical features from behavioral & telemetry data
Example: Gradient Boosted Trees (XGBoost, LightGBM)
Detects patterns like feature usage impact on NPS

Temporal / Sequence Model
Uses sequential behavior data (clicks, sessions, events)
Example: LSTM or Transformer
Captures trends and user behavior over time

Text / NLP Model
Uses user comments and survey responses
Example: BERT embeddings or other LLM-based text vectors
Extracts sentiment, topics, and context

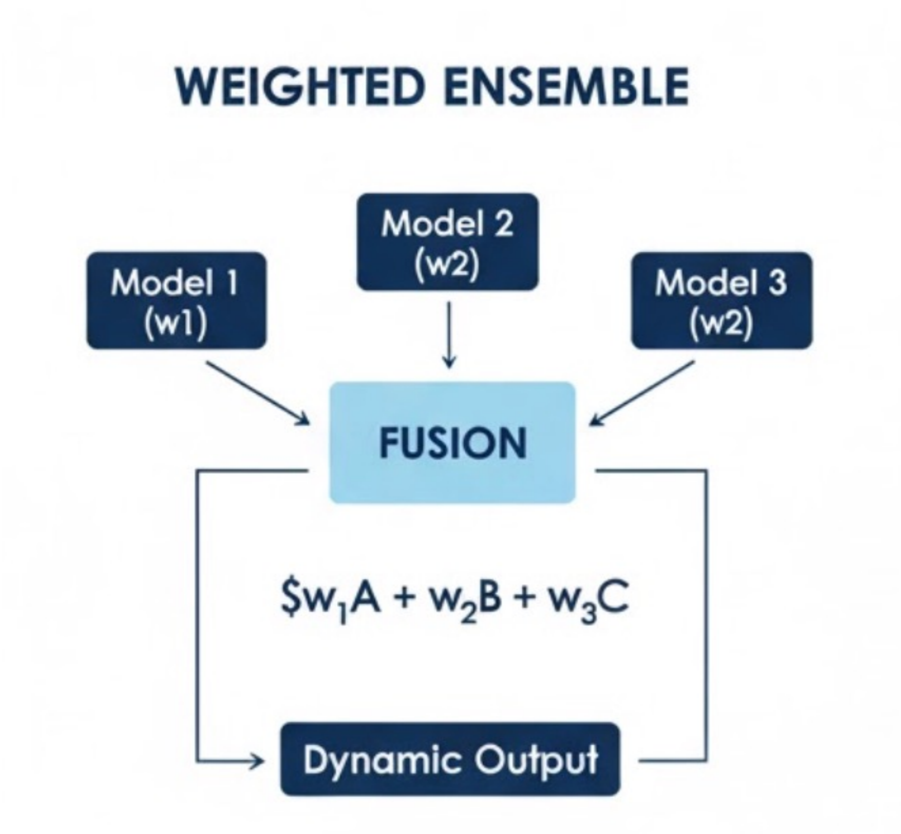


Fusion Layer – Combining AI Insights

Collects outputs from **structured, temporal, and text models**

Learns to weight each input based on its importance for the prediction

Does not treat all data equally — prioritizes the most relevant signals



Fusion Layer – Explainable AI (XAI)

Clarifies why a prediction was made by showing which features or behaviors influenced the NPS score.

Uses SHAP and LIME to break down the model output into human-readable explanations.

Improves trust and transparency so stakeholders understand the reasoning behind AI decisions.

Helps with debugging and validation by revealing unexpected or incorrect model behavior.

Supports compliance and audit needs by providing clear justification for each prediction.

XAI increases confidence by showing how and why predictions are made.

Prediction & Interpretation

- Produces the final **dynamic NPS score**
- Provides the **confidence level** of the prediction
- Shows **root-cause factors** affecting the score
- Suggests **actionable recommendations**
- Delivers insights through **business dashboards**

Prediction Results & Model Performance

Proposed **DNPS hybrid model** achieves **~85.9% accuracy**, outperforming all baselines

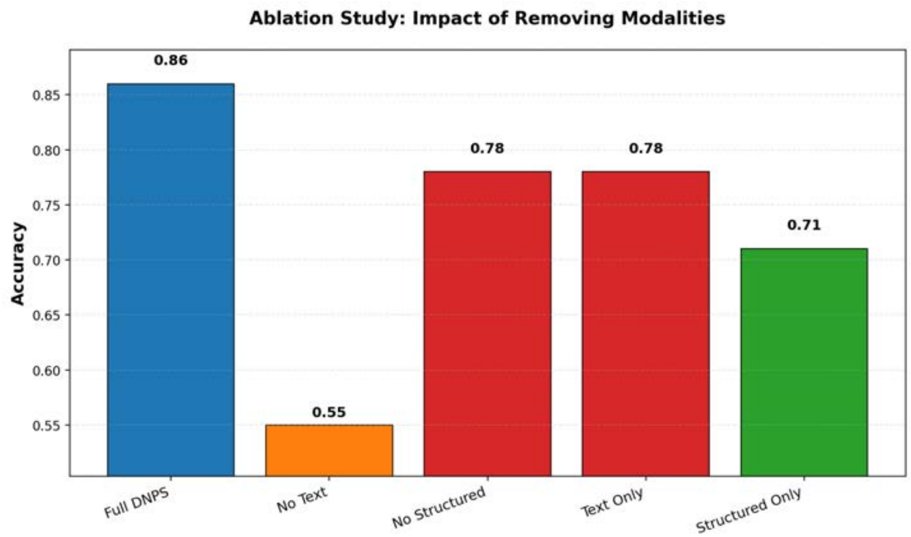
Lower error: **MAE ~1.21**, strong F1 score

Multi-modal fusion (behavior + telemetry + text) performs far better than single-modality models

Ablation shows the importance of each data type:

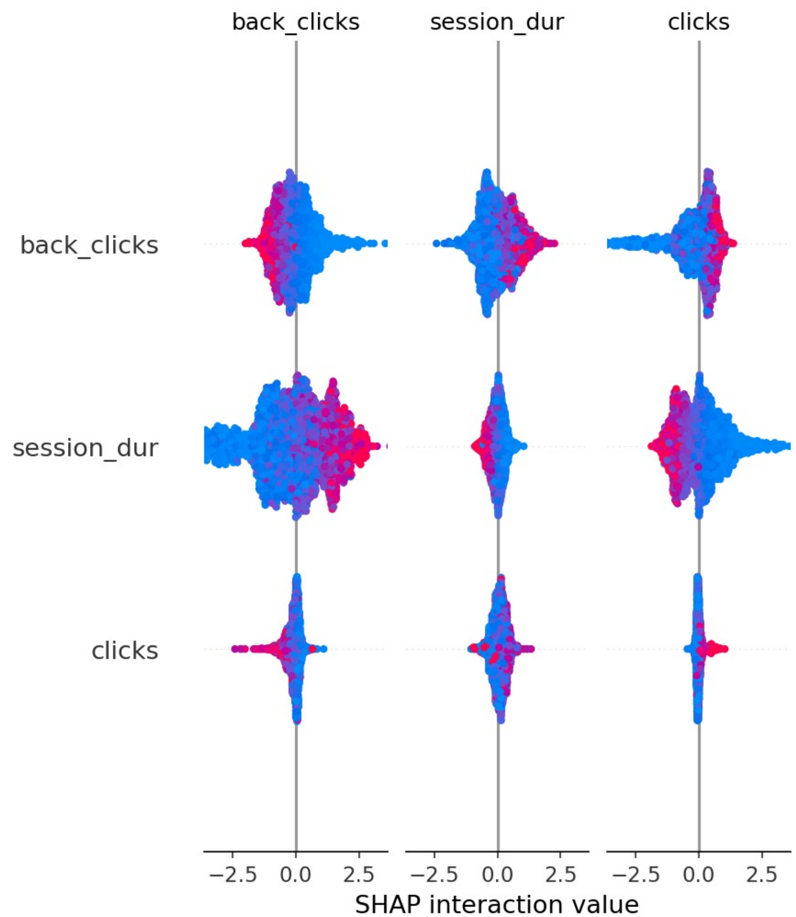
- Removing text: accuracy drops to **~55%**
- Removing behavioral/telemetry: drops to **~78%**

Real-time inference runs in **~80 ms**, supporting live dashboards and operational use



Explainability, Insights & Business Value

- SHAP/LIME analysis reveals **top drivers** of NPS:
  - High **back-clicks** → strong negative impact
  - **Short session duration** → lower satisfaction
  - High **click activity** → promoter behavior
- Provides **root-cause insights** such as buffering issues or negative feedback patterns
- Helps teams make **proactive decisions** (feature fixes, UX improvements)
- Reduces dependence on surveys by providing **continuous, dynamic NPS**
- Enables **business dashboards** with real-time predictions and explanations



Limitations & Future Work

Limitations

- Requires large, high-quality datasets
- Cold-start issues for new users
- Hybrid model complexity
- Possible bias in text feedback

Future Work

- Add more diverse data sources
- Use advanced transformer-based models
- Improve cold-start handling
- Enhance real-time explainability

Thank You