Power BI Model Deployment and Predictive Analytics Framework

1 Power BI Model Deployment

1.1 Prediction Dataset Availability

The operational prediction interface is implemented as a Microsoft Power BI application. Power BI imports the `All_Students_for_Prediction.csv` file, containing student records for those who have not yet completed their studies. The dataset includes all independent variables required by the trained predictive model.

1.2 Power Query Executes the Trained XGBoost Pipeline

Power BI uses Python integration in Power Query to run the trained XGBoost pipeline and compute graduation probabilities.

```
import pandas as pd
import joblib

df = dataset.copy()
pipe = joblib.load("C:\\Users\\Administrator\\UMBC_MODEL\\
   UMBC_Tuned_Model_PowerBI.joblib")
df["Grad_Prob"] = pipe.predict_proba(df)[:, 1]
dataset = df
```

Three main operations occur:

1. The complete trained XGBoost pipeline is loaded.
2. The model predicts the probability of graduation (class 1) for each student.
3. A new column `Grad_Prob` is added to the dataset.

The Power BI table now includes real-time, model-generated graduation probability estimates for further analysis and scenario simulations.

2 Interactive DAX Measures for Threshold Adjustment

Power BI measures allow institutional decision-makers to modify graduation success thresholds dynamically.

2.1 Selected Student Probability

```
Selected_Grad_Prob = AVERAGE(Students[Grad_Prob])
```

This measure computes the graduation probability for the selected student of students.

2.2 User-Defined Graduation Threshold

A What-If parameter named `GradThreshold Value` lets users specify the minimum acceptable probability.

2.2.1 Margin Relative to Threshold

```
Grad_Margin_vs_Threshold =
    [Selected_Grad_Prob] - [GradThreshold Value]
```

This measure returns the numerical difference between the selected student's probability and the threshold.

2.2.2 Above/Below Interpretation

```
Grad_vs_Threshold_Label =
IF(
    [Selected_Grad_Prob] >= [GradThreshold Value],
    "Above your graduation threshold",
    "Below your graduation threshold"
)
```

A text-based interpretation helps users understand student standing without using decision-oriented terminology.

3 User-Controlled Completion Time Bands

Additional What-If parameters enable exploration of 4-year and 5-year completion standards.

```
GradDuration =
VAR prob = [Selected_Grad_Prob]
VAR t4 = [Threshold_4year Value]
VAR t5 = [Threshold_5year Value]
RETURN
```

```
SWITCH(
    TRUE(),
    prob >= t4, "Within your 4-year band",
    prob >= t5, "Within your 5-year band",
    "Below both your 4-year and 5-year bands"
)
```

This measure classifies students into time-based completion categories.

4 XGBoost-Based Support Impact Simulation

A separate Python script simulates how changes in financial support influence graduation outcomes. The script varies `TotalSupport` while holding all other features at their baseline medians or modal values.

The model produces `SupportEffectCurve.csv`, containing graduation probabilities:

TotalSupport	GraduationProbability
0	0.47
500	0.49
⋮	⋮

This simulates the marginal effect of support on student outcomes under controlled input conditions.

5 Power BI Support Curve Integration

5.1 Support Slider Parameter

A What-If parameter named `SupportAmount` allows users to input a hypothetical support level.

5.2 Mapping Support to Predicted Probability

The discrete simulation table requires a measure to select the nearest support amount not exceeding the chosen value:

```
Adjusted_Grad_Prob_FromSupport =
VAR amt = [SupportAmount Value]
VAR nearest =
    CALCULATE(
        MAX(SupportEffectCurve[TotalSupport]),
        FILTER(
            ALL(SupportEffectCurve),
            SupportEffectCurve[TotalSupport] <= amt
        )
    )
```

```
RETURN
CALCULATE(
    MAX(SupportEffectCurve[GraduationProbability]),
    SupportEffectCurve[TotalSupport] = nearest
)
```

5.3 Support-Induced Lift

```
Support_Lift =
    [Adjusted_Grad_Prob_FromSupport] - [Selected_Grad_Prob]
```

This measure reports how much graduation probability is gained due to increased support.