Enrollment Projection Model

Presented by: Institutional Knowledge Management
Your Presenters

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  - IR Research Analyst
University of Central Florida (UCF)
Stakeholders

• Institutional Research (IR) provides enrollment projection data to Asst. VP Institutional Knowledge Management

• Figures are required for state reporting and internal planning

• Group effort –
  – Undergraduate Admissions
  – Graduate Admissions
  – Student Development and Enrollment Services
Projection Model - Original

- Behavior measured across multiple years
  - Slow to react to new trends
- Multiple excel files, various source code locations (copy and paste)
  - Difficult to navigate
- Model is cohort based
- Definitions are hard-coded and outdated
- Judgement on factors made by the IR staff and manually updated in model
- Difficult to explain to the user
Projection Model - Request

• Flexible
  – Meet multiple needs with one design

• Interactive
  – Decision makers should be able to interact with the tool to see immediate effect

• Reactive
  – Projections should reflect most recent known student behavior

• Explainable
  – Users should clearly understand how the figures are calculated
  – All figures are derived from formulas—no developer judgement applied
Development – Baseline Testing

• Open Source data mining and statistical software
  – R – Forecasting
  – Weka – Modeling

• Baseline Study – Non-Seasonal Forecasting
  – Forecasting techniques
    • Exponential Smoothing
    • Damped (Additive/Multiplicative)
    • Holts Linear
Baseline Testing – Fall Headcount w/ Forecasting
Baseline Testing – Fall Headcount w/ Forecasting

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
<th>Original</th>
<th>Forecast - TMEAN</th>
<th>Forecast - NMEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>58,698</td>
<td>58,879</td>
<td>58,467</td>
<td>58,111</td>
</tr>
<tr>
<td>2012</td>
<td>59,785</td>
<td>60,048</td>
<td>60,754</td>
<td>60,001</td>
</tr>
<tr>
<td>2013</td>
<td>59,770</td>
<td>60,870</td>
<td>63,069</td>
<td>61,919</td>
</tr>
<tr>
<td>2014</td>
<td>60,810</td>
<td>62,193</td>
<td>65,352</td>
<td>63,867</td>
</tr>
</tbody>
</table>
Baseline Testing – Modeling

• Similar Premise
  • Previous enrollment data are good predictors for current Fall headcount.

• Used various inputs
  • Previous Fall HC, Graduate students, FTIC, New Students etc.

• Used Two Methods
  • Neural Network
  • Regression
  – Different Variable Selection Methods
Baseline Testing – Modeling & Forecasting Results

- Both use a rate * Previous Fall Headcount
- 23,220 represents general estimate of new students in an academic year
- “Aha Moment”

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
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<td>59,770</td>
<td>60,810</td>
</tr>
<tr>
<td>Original</td>
<td>58,879</td>
<td>60,048</td>
<td>60,870</td>
<td>62,193</td>
</tr>
<tr>
<td>(1.05*PY Total - 331.3)</td>
<td>58,984</td>
<td>61,470</td>
<td>62,615</td>
<td>62,599</td>
</tr>
<tr>
<td>Linear Regression (overfit)</td>
<td>58,950</td>
<td>59,649</td>
<td>60,974</td>
<td>61,566</td>
</tr>
<tr>
<td>.62* PY Total + 23220</td>
<td>58,148</td>
<td>59,612</td>
<td>60,286</td>
<td>60,277</td>
</tr>
<tr>
<td>.91*PY Total + 6201</td>
<td>57,468</td>
<td>59,616</td>
<td>60,605</td>
<td>60,592</td>
</tr>
<tr>
<td>Fcast - TMEAN</td>
<td>58,467</td>
<td>60,754</td>
<td>63,069</td>
<td>65,352</td>
</tr>
<tr>
<td>Fcast - NMEAN</td>
<td>58,111</td>
<td>60,001</td>
<td>61,919</td>
<td>63,867</td>
</tr>
<tr>
<td>Neural (w/sel)</td>
<td>58,340</td>
<td>58,992</td>
<td>59,355</td>
<td>59,265</td>
</tr>
</tbody>
</table>
Fall Headcount - Logic

Returning – Enrolled last Fall

New – Admitted following Spring

Not enrolled last Fall, not new admit

New – Admitted following Summer

– New Admitted this Fall

– Reappearing
Assumption: Consistent student behavior

Student behavior in future years will mimic the most current behavior available by each student type (unless an intentional change in rates is applied to the model).

Data Sources

Historical data comes from static data files stored in IKM’s data warehouse:

- Admissions File
- Student Instruction File
- Early versions of the files are used when final files are not yet available
Headcount: Projected Fall Enrollment

Fall 2015 Projected Enrollment =

(\text{Fall 2014 Actual Enrollment} \times \text{Most Recent Fall to Fall Return Rate}) + (\text{Spring 2015 New Admits} \times \text{Most Recent Spring Admits to Fall Return Rate}) + \text{Summer 2015** New Admits} + \text{Fall 2015** New Admits} + \text{Most Recent Fall Reappearing Students}

**Note:** Actual “new admits” are used when available, estimates are used when actual not yet available. “New admits” reflect actual new incoming students.
Headcount: Projected Fall Enrollment

Fall 2016 Projected Enrollment =

\[
\text{Fall 2015 Projected Enrollment} \times \left( \text{Most Recent Fall to Fall Return Rate} \right) + \left( \text{Spring 2016 New Admits} \times \text{Most Recent Spring Admits to Fall Return Rate} \right) + \left( \text{Summer 2016 New Admits} + \text{Fall 2016 New Admits} + \text{Most Recent Fall Reappearing Students} \right)
\]
Headcount: Projected Spring Enrollment

Spring 2015 Projected Enrollment = 

\[
\text{Fall 2014 Actual Enrollment} \times \left( \text{Most Recent Fall to Spring Return Rate} \right) + \text{Spring 2015 New Admits} + \text{Most Recent Spring Reappearing Students}
\]

Spring 2016 Projected Enrollment = 

\[
\text{Fall 2015 Projected Enrollment} \times \left( \text{Most Recent Fall to Spring Return Rate} \right) + \text{Spring 2016 New Admits} + \text{Most Recent Spring Reappearing Students}
\]
Headcount: Projected Summer Enrollment

Summer 2015 Projected Enrollment =

\[
(\text{Spring 2015 Actual Enrollment} \times \text{Most Recent Spring to Summer Return Rate}) + \text{Summer 2015 New Admits} + \text{Most Recent Summer Reappearing Students}
\]

Summer 2016 Projected Enrollment =

\[
(\text{Spring 2016 Projected Enrollment} \times \text{Most Recent Spring to Summer Return Rate}) + \text{Summer 2016 New Admits} + \text{Most Recent Summer Reappearing Students}
\]
Student Credit Hours (SCH)

Using Projected Headcount, apply the most recent average credit load for Full-Time (FT) and Part-Time (PT) students for each type and term.

(Total Annual SCH = Summer SCH + Fall SCH + Spring SCH)

\[
(\text{Fall Projected Enrollment} \times \text{Last Year’s Avg Fall Credit Hr Load for FT}) + (\text{Fall Projected Enrollment} \times \text{Last Year’s Avg Fall Credit Hr Load for PT})
\]
SAS® Enterprise Guide was used to collect the historical N’s and generate return factors or percentages from Admissions and Enrollment tables stored in the warehouse.

Results are stored in SAS® data tables that will be surfaced using the SAS® plug-in for Excel.
Stakeholder Inputs

Headcount and SCH update dynamically
Values roll over with new model year

**Estimated future entering students:** Input by N or Growth Factor

![Table](attachment:image.png)
### Estimated Return Rates

**This table requires manual inputs**

<table>
<thead>
<tr>
<th>Week</th>
<th>Most Recent Actual</th>
<th>Estimated Return Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. FTIC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>0.5284</td>
<td>0.7300</td>
</tr>
<tr>
<td>Fall</td>
<td>0.726</td>
<td>0.9100</td>
</tr>
<tr>
<td>Spring</td>
<td>0.9132</td>
<td>0.9100</td>
</tr>
<tr>
<td><strong>2. FCS Transfer</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>0.5446</td>
<td>0.5700</td>
</tr>
<tr>
<td>Fall</td>
<td>0.5734</td>
<td>0.8195</td>
</tr>
<tr>
<td>Spring</td>
<td>0.8211</td>
<td>0.8195</td>
</tr>
<tr>
<td><strong>3. Other Transfer</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>0.582</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>0.632</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>0.8474</td>
<td></td>
</tr>
<tr>
<td><strong>4. 2nd Deg Undergrad</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>0.5716</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>0.4438</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>0.7293</td>
<td></td>
</tr>
<tr>
<td><strong>5. Unclassified</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>0.4982</td>
<td></td>
</tr>
<tr>
<td><strong>6. Master’s</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>0.5724</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>0.4937</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>0.8175</td>
<td></td>
</tr>
<tr>
<td><strong>7. Doctoral</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>0.7151</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>0.5606</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>0.9188</td>
<td></td>
</tr>
<tr>
<td><strong>8. Other Graduate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td>0.2568</td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>0.2747</td>
<td></td>
</tr>
<tr>
<td>Spring</td>
<td>0.5014</td>
<td></td>
</tr>
</tbody>
</table>

No value defaults to actual

Camera tool shows live data changes
Snapshot View

Projected Fall Headcount

Projected Annual SCH
Model refresh updates with the most current data
Single button triggers macros

Model automatically rolls model forward when new model year added to dataset

Run this after updating EG project:

Refresh Model
Behind the Scenes

- SAS® Add-in for MS Office used to import data
- Flags in the dataset eliminate need to update Excel filters
- Calculations to create the projections in background worksheets
  - Primarily use lookup, math, and logic functions
- Refreshing the data does not change the layout in Excel
  - Formulas for lookup helper columns do not need to be adjusted or monitored
How Did the Model Do?

Fall 2015: Returns

Projected: 43,655
Actual: 44,064
*PE = .93%

Fall 2015: Total Headcount

Projected: 61,597
Actual: 62,991
*PE = 2.2%
Questions?
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