

2021 AAA Annual Meeting

11.02: Data Analytics Resources from the University of Illinois— Deloitte Foundation Center for Business Analytics

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Agenda

1. Welcome and introductions
2. Beth Mueller
3. Overview of data analytics, curricular mandates, and curricular challenges
4. Our effort to alleviate those challenges
 - A. Overview of the UofI-Deloitte Foundation Center
 - B. Walkthrough of available materials
 - C. Walkthrough of Yellow Cab Case

Analytics in General



Definition of analytics in accounting

The science and art of discovering and analyzing patterns, identifying anomalies, and extracting other useful information in data (AICPA 2014, p. 5)



Analytics education in general

- Melting pot of
 - Math
 - Statistics
 - Computation
 - Information Science
 - Specific Domain



Data analytics competencies

Foundational knowledge (undergrad)

- Computational foundations (programming basics & algorithmic thinking, computer basics)
- Mathematical foundations (probability, calculus, linear algebra)
- Statistical foundations (hypothesis testing, inference, sampling, distributions, regression, etc.)

Data analytics competencies

Data Analytics (undergrad or grad)

- Data Analytics (the whole data workflow, from problem identification to basic ML)
 - E.g., Data workflow; Basic data modeling / ML; Inference; Algorithms; Big data / Cloud
- Data Governance, Ethics, Management, & Curation
- Data Mathematical Modeling / Algorithm Training (ML to deep learning)
- Data Representation / Visualization (dashboards, EDA, grammar of graphics)
- Data Structures (algorithm design, optimization)
- Soft skills / Communication / Teamwork

Data Analytics Mandates/Requirements



CPA changes for 2021

Auditing and Attestation (AUD)

- Using audit data analytic (ADA) techniques
 - To identify transactions that may have a higher risk of material misstatement
 - In audit sampling
 - In recalculations
- Analyzing and understanding the results of an ADA procedure

CPA changes for 2021

Business Environment and Concepts (BEC)

- Business processes and flows of transactions
- Extracting and loading data
- Transforming and working with data
- Data governance and data management

Analytics required by AACSB

- Standard 5 (formerly 7) for accounting (Standard 9 for general business)
- Introduced in 2013 and effective June 30, 2016
- Standard 9 requires “current emerging business statistical techniques, data management, data analytics and information technology” (AACSB 2018, p. 37).
- Why? Due to increase in expectations for data analytics and information technology

AACSB Standard 5

“Accounting degree programs include learning experiences that develop skills and knowledge related to the integration of information technology in accounting and business. This includes the ability of both faculty and students to adapt to emerging technologies as well as the mastery of current technology.”

3 components

- Information systems and business processes
 - E.g., data creation, manipulation, security, and storage
- Data analytics
 - E.g., statistical techniques; clustering; data management; modeling; analysis; text analysis; predictive analytics; learning systems; visualization
- Technology agility - continual learning



What Skills Does Accounting Practice Require?

M T W T F S S

						1				
				5	6	7	8			
				9	10	11	12	13	14	15
				16	17	18	19	20	21	22
				23	24	25	26	27	28	29
				30	31					

Abbreviated history of analytics in accounting

Early 1980

Computer assisted techniques and programs: ACL - audit command language & IDEA - interactive data extraction and analysis

2012

AICPA forms technology task force to look at the role of big data in audit

2013

AACSB requires analytics education in accounting programs

2014-Present

Major accounting firms announce spending on technology

Incomplete list of Big Four spending on technology

- 2014
 - KPMG: \$100 million for developing data analytical capabilities for audits
 - EY: \$400 million for audit innovation, including analytics
 - PwC: Developed in house analytics tool
- ~2019
 - EY: \$1 billion, two-year technology investment
 - KPMG: \$5 billion, five-year investment in technology
 - PwC: \$3 billion, four-year technology and training
- 2020 – EY: announces corporate MBA free to all EY people, partly focused on technology
- 2021 – PwC: \$12 Billion on Hiring, Expanding Expertise in AI, Cybersecurity
- Other
 - KPMG: Partners with Universities to run analytics Master's degrees
 - DT: Funds Uofl-Deloitte Foundation Center for Business Analytics

Audit use of analytics

- Use all journal entries to find audit exceptions (direct, on-demand access to client data)
- Better-supported risk assessments
- Dazzling visuals to provide new insights to clients
- Data-supported arguments for estimate write-downs
- Examination of previously unused unstructured data
 - e.g., use google maps to verify travel expenses
- Recalculations can be done via centralized services
 - e.g., recalculate depreciation calculations



What is needed?

- "We need people who are a lot more literate in using data. So, if you've got pilot data that you want to use, you will have to identify and think about it in terms data fields, data groups, data bases, how they can be appended, ..., and how that all can be manipulated." p. 108
- "Fundamentally, we need to put analytics into the hands of the auditors as opposed to the specialists." p. 110
 - because specialists are expensive, finite, and not auditors and shouldn't be doing audit steps

Data-Savvy Accountant



Data Scientist

Traditional
Accountant

What is happening now in accounting programs?

- Lots of variation
- Most have an undergrad AIS class, but does this teach analytics?
- The curriculum is not close to Standard 5 recommendations
 - 93% teach spreadsheets
 - 85.5% teach Tableau (or other BI software)
 - 32% programming (R) and query (SQL)
- Faculty expertise is the main hurdle

Two approaches to add analytics

- Standalone analytics courses
- Integration across existing courses



The University of Illinois - Deloitte Foundation Center for Business Analytics

How We Are Trying to Help



The University of Illinois - Deloitte Foundation Center for Business Analytics

Access Data Analytics Content

The University of Illinois-Deloitte Foundation Center for Business Analytics will provide a wealth of resources that can be implemented into existing business curricula. Resources developed by the Center include leading-edge course material, case studies, symposia, and workshops.



[Courses](#)



[Symposia and Workshops](#)



[Case Studies](#)



[Blogs](#)





Blogs



Courses



Symposia and Workshops



Case Studies



Courses

Course 1: First half of analytics workflow

- Introduction to Python => ETL => EDA

Course 2: Applied analytics in Python

- Text, Databases, SQL, Time series

Course 3: Machine learning in Python



Case Studies

Multi-class-period cases

- Customer segmentation
- Databases for accountants
 - Managerial accounting setting
 - Relational databases
 - SQL & Python
- Data analytics workflow
 - Python & Tableau
 - Load, clean, explore, visualize, regression



Case Studies

Mini-cases (less than one class period)

- Data analytics skills in management control systems
 - “results control”
 - “personnel control”
 - “cultural control”

- Course concepts in analytics in R
- Ethics in technology
- Audit and tax cases
- Healthcare analytics
- Much, much more



How to access our materials



<https://giesbusiness.illinois.edu/experience/academies-centers/the-university-of-illinois-deloitte-foundation-center-for-business-analytics>

How the Center can help you integrate analytics into your curriculum

1. Standalone analytics courses
 - “Data Analytics Foundations for Accountancy I”:
First half of analytics workflow in Python
 - “Second Course in Foundations of Data Analytics”:
Machine learning in Python
 - Cases: multiple
2. Integration across existing courses
 - Managerial accounting: (1) “An Introduction to Databases for Accountants”; (2) “Mini-Case Studies”
 - Intro / Auditing: “Yellow Cab”

A close-up photograph of a yellow taxi horn. The horn is a polished, metallic, teardrop-shaped object with a circular opening in the center. It is mounted on a yellow surface, likely the front of a taxi. Below the horn is a black and white checkered trim strip. The background is slightly blurred, showing the interior of the taxi and the window.

Walk through of Yellow Cab Case

Summary

- Advisory case
- Learning Objectives
 - Python
 - Store and access data via Pandas and CSV
 - Clean data in Pandas
 - Descriptive analytics
 - Regression
 - Tableau
 - Descriptive analytics: Visualization via box plots, scatter plots, and maps
 - Story telling from a business analytics point of view

Summary

- Multi-day case (can be broken into parts)
- Sections 1-4: ETL in Python (clean outliers, create dates, drop nulls)
- Section 5: EDA in Tableau
- Section 6: Linear regression
- Section 7: Generate evidence-support recommendations

Data Analysis

Average Total/Second by Shift and Day of the Week

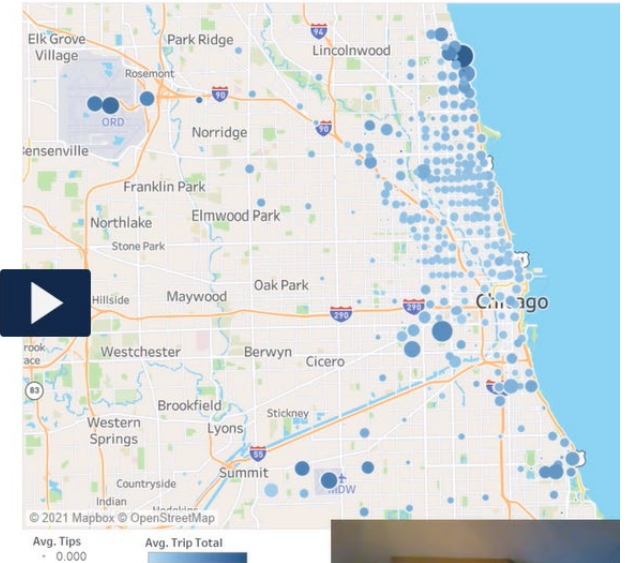


Business Analysis Recommendations Data Analysis Evidence Takeaways Additional

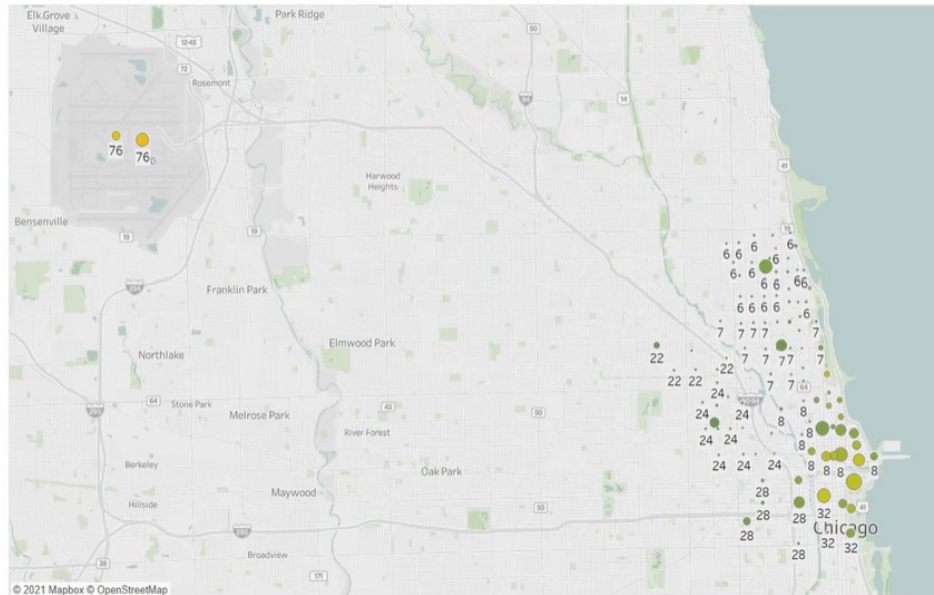
Trip Revenue by Location (2015)

- Highest average trips are in areas 74, 76 and 56. These areas are also in the top 4 by tips.
- These areas contain Midway and O'Hare airports and are areas at the city outskirts.

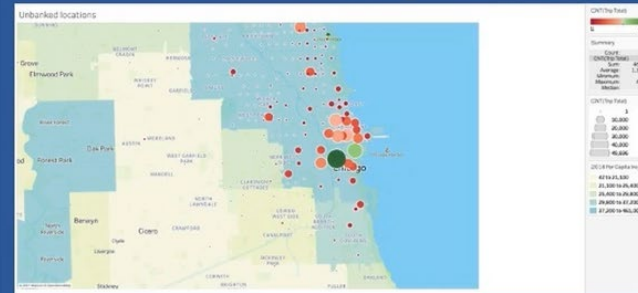
Average trip and tip total by pickup area



Map of by Avg Total per Sec and Trip Count - Above Avg Pickup Community Areas



Unbanked Community Locations for Business Expansion



City Locations:

- West Town

Suburb Locations:

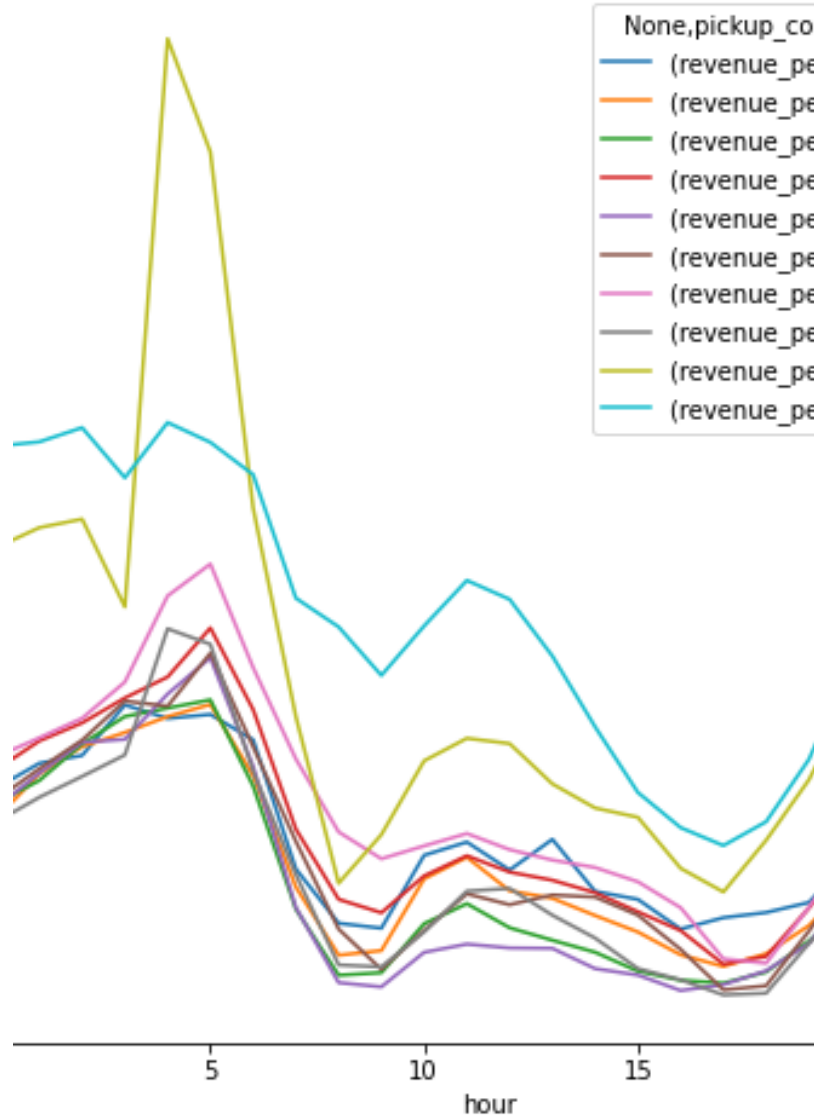
- Elmwood Park



```
ur.plot.line(figsize=(8, 8), title=('Top 10 Com
```

```
lot:title={'center':'Top 10 Communities Revenue
```

Top 10 Communities Revenue per second by Ho



```
[55]: top_area_revenue = f.pivot_table(values = ['trip_total'],in  
aggfunc = {'trip_total' : 'sum'})
```

```
top_10_revenue=top_area_revenue.sort_values(by='trip_total'  
top_10_revenue
```

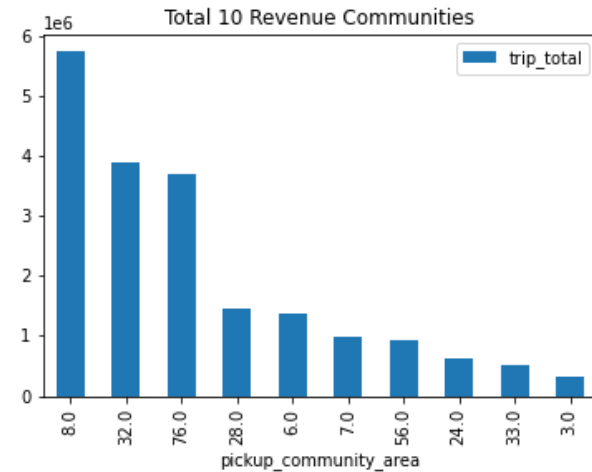
```
[55]: trip_total
```

```
pickup_community_area
```

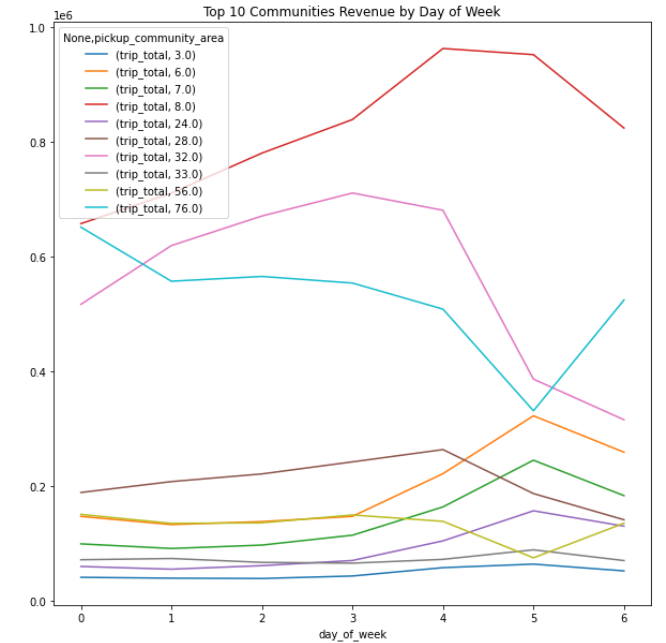
8.0	5.725642e+06
32.0	3.898456e+06
76.0	3.689600e+06
28.0	1.448131e+06
6.0	1.364711e+06
7.0	9.900547e+05
56.0	9.158439e+05
24.0	6.337479e+05
33.0	5.048611e+05
3.0	3.320018e+05

```
[56]: top_10_revenue.plot.bar(title='Total 10 Revenue Communities
```

```
[56]: <AxesSubplot:title={'center':'Total 10 Revenue Communities'
```



```
[57]: <AxesSubplot:title={'center':'Top 10 Communities Revenue by Day of Week'}, xlabel='day_of_week' >
```



```
clean_data_rest['ExpArea'] = clean_data_rest['pickup_community_area']  
  
# Stack both dataframes  
clean_data_v2 = pd.concat([clean_data_expAreas,clean_data_rest])  
  
Hours = range(13,23)  
clean_data_v2 = clean_data_v2[(clean_data_v2.Hour.isin(Hours))]  
  
# Quantify Revenue Impact by Top 3 expensive pickup areas vs the res  
  
LR_top3_rest = smf.ols(formula='trip_total ~ C(ExpArea) + trip_secor  
LR_top3_rest.summary()
```

```
[59]:
```

OLS Regression Results			
Dep. Variable:	trip_total	R-squared:	0.864
Model:	OLS	Adj. R-squared:	0.864
Method:	Least Squares	F-statistic:	6.022e+05
Date:	Sun, 16 May 2021	Prob (F-statistic):	0.00
Time:	23:06:01	Log-Likelihood:	-1.7371e+06
No. Observations:	570592	AIC:	3.474e+06

A close-up photograph of a yellow taxi horn. The horn is a polished, metallic, teardrop-shaped object with a circular opening in the center. It is mounted on a yellow surface, likely the front of a taxi. Below the horn is a black and white checkered trim strip. The background is slightly blurred, showing the interior of the taxi and the window.

Walk through of Yellow Cab Case



Gies Business

Thank you