



Data science and engineering for property tax equity

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Cook County Assessor's Office | Data Team



Hypothetical average Chicago home in 2015:

Average **estimated value:** **\$237,000**

Average **property tax bill:** **\$3,600**

OPINION

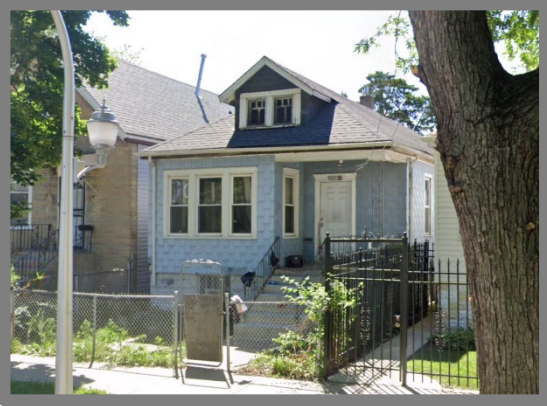
E How Lower-Income Americans Get Cheated on Property Taxes

Many homeowners are paying a total of billions of dollars extra because of inequities in assessing property values.

”

April 3, 2021

Chicago



\$100K sale



\$1M sale

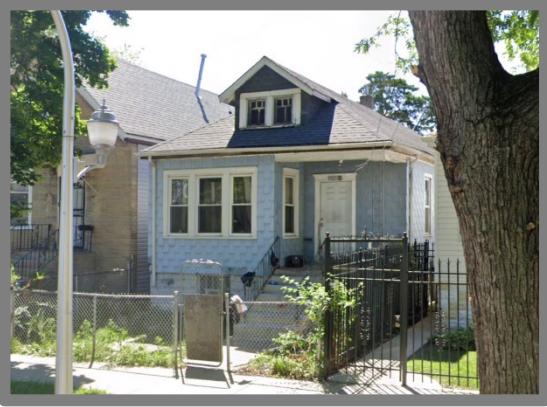
Bottom 10%

Top 10%

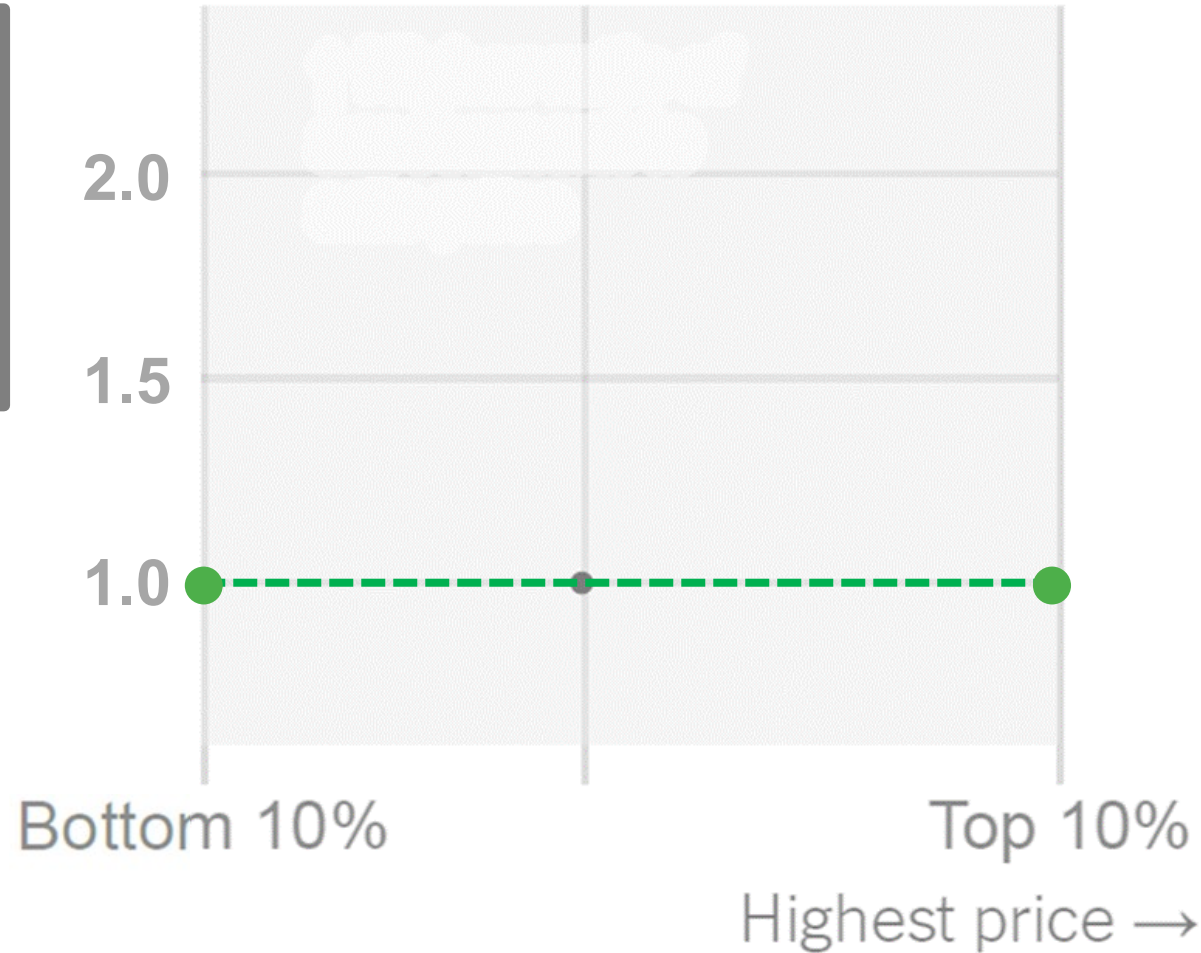
Highest price →

Source: **Chris Berry/NYT**, using assessments from prior years

Chicago



\$100K estimate
÷ **\$100K** sale
= **1.0 ratio**



\$1M estimate
÷ **\$1M** sale =
1.0 ratio

Source: **Chris Berry/NYT**, using assessments from prior years

Chicago



\$150K estimate
÷ **\$100K** sale
= **1.5 ratio**



\$800K estimate
÷ **\$1M** sale
= **0.8 ratio**

Source: **Chris Berry/NYT**, using assessments from prior years

Chicago



\$150K estimate
÷ **\$100K** sale
= **1.5 ratio**



\$800K estimate
÷ **\$1M** sale
= **0.8 ratio**

Source: **Chris Berry/NYT**, using assessments from prior years

Data Science & Analytics: better modeling practices

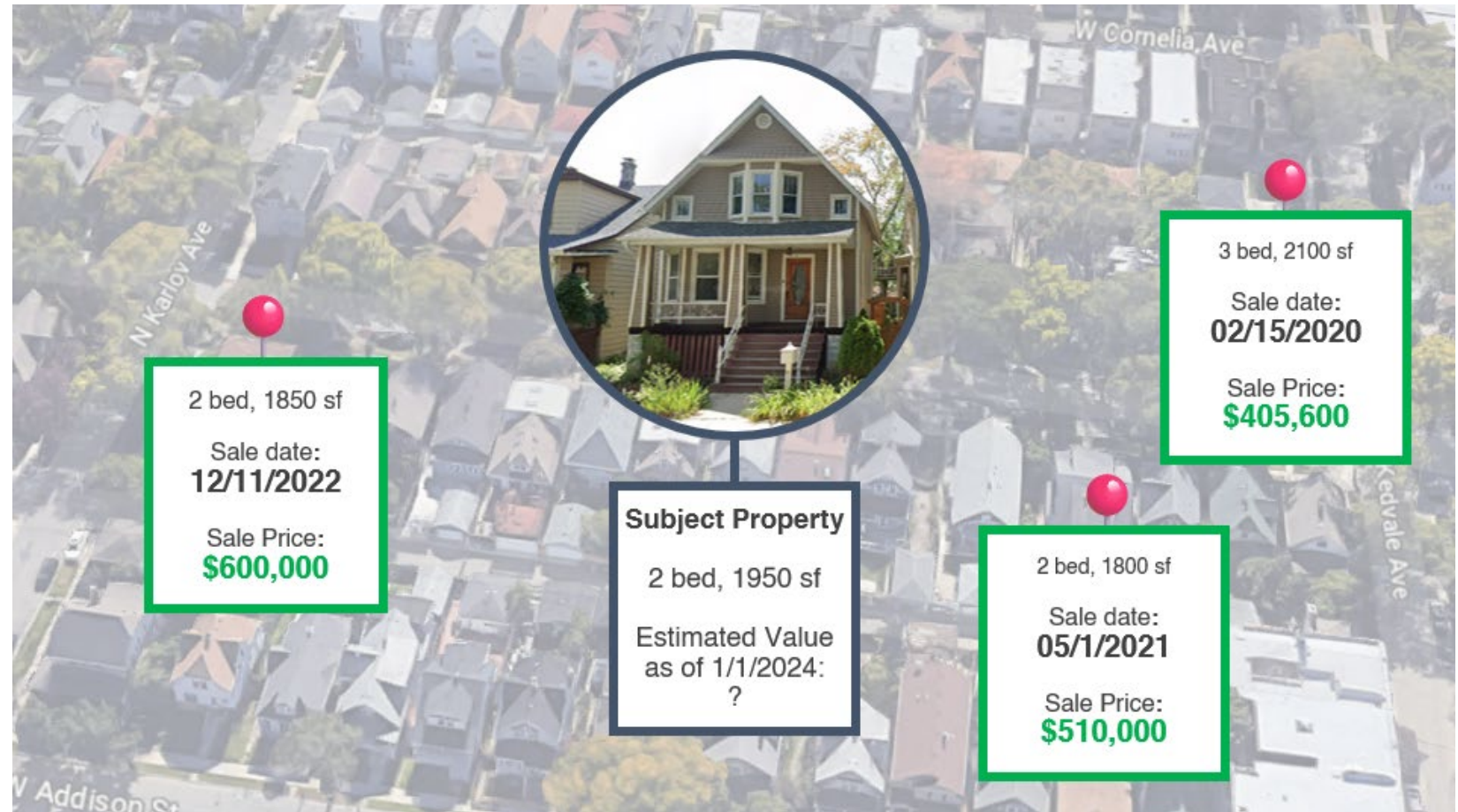
1. *Better feature engineering*
2. *Better training data*
3. *Better modeling*

Assessing property values 101

The job of the Assessor's Office is *mass appraisal*:

We estimate the property's current market value (as of January 1), every year.

What drives real estate value?



1. Better feature engineering: Location

Then

system of record

Geospatial features

- Assessor neighborhood

Now

system of record + feature engineering

Geospatial features

- Assessor neighborhood
- ✓ Flood risk (First Street)
- ✓ Floodplain (FEMA)
- ✓ Airport noise
- ✓ Proximity to amenities
- ✓ Proximity to disamenities
- ✓ School
- ✓ School ratings
- ✓ Walkability

1. Better feature engineering: Location

Mainframe + AS/400

+

| Feature | Data Source |
|---|---|
| Tax rate | Cook County Clerk's Office |
| Airport noise | Noise monitoring stations via the Chicago Department of Aviation |
| Road proximity | Buffering OpenStreetMap motorway, trunk, and primary roads |
| Flood risk and direction | First Street flood data |
| All Census features | ACS 5-year estimates for each respective year |
| Elementary school district or attendance boundary | Cook County school district boundaries and CPS attendance boundaries |
| High school district or attendance boundary | Cook County high school district boundaries and CPS high school attendance boundaries |
| Walkability | The Chicago Metropolitan Agency for Planning's ON TO 2050 Walkability Scores |
| Subdivision, unincorporated areas, SSAs, etc. | Cook County GIS |
| PUMA Housing Index | DePaul Institute for Housing Studies |
| School Ratings | GreatSchools.org , aggregated to the district level |
| Distance to CTA, PACE, Metra | Each agency's respective GTFS feed , which contains the location of stops and lines |

Now

system of record + feature engineering

Geospatial features

- Assessor neighborhood
- ✓ Flood risk (First Street)
- ✓ Floodplain (FEMA)
- ✓ Airport noise
- ✓ Proximity to amenities
- ✓ Proximity to disamenities
- ✓ School
- ✓ School ratings
- ✓ Walkability

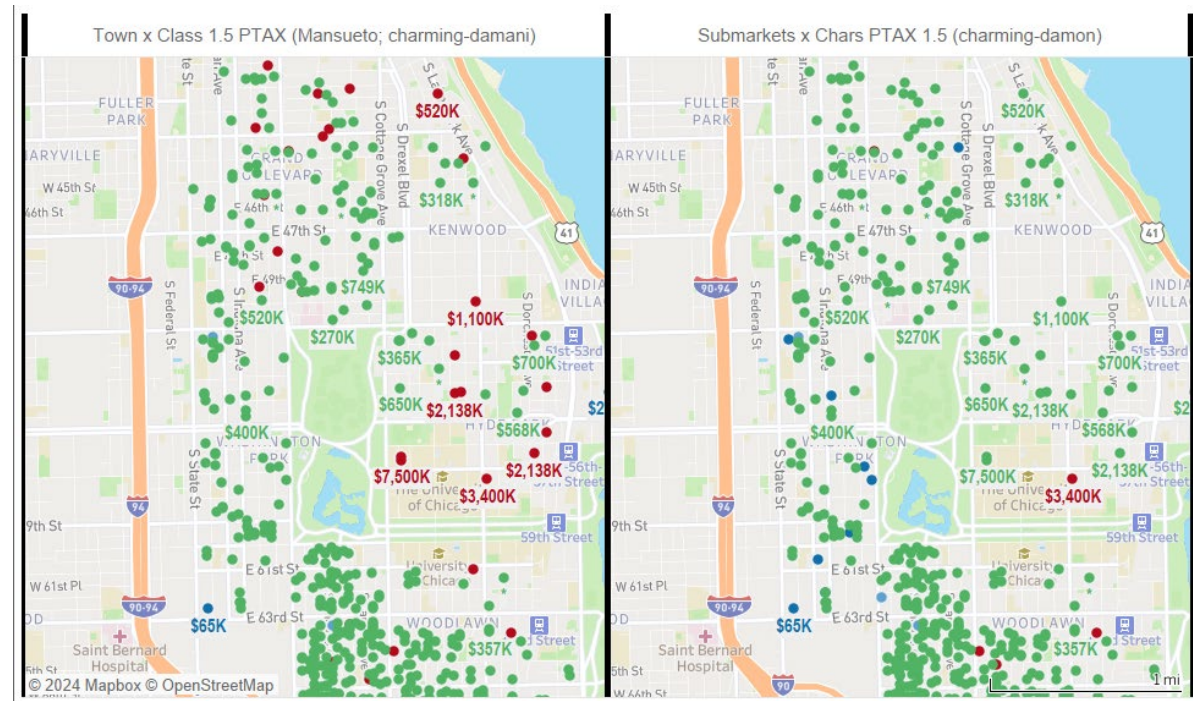
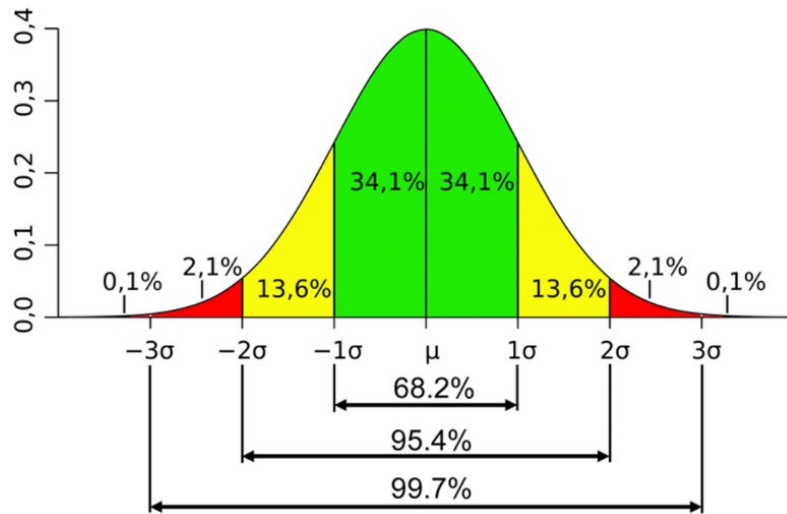
2. Better training data

 @ccao-data/model-sales-val

🚩 *Problem:* some sales are **outliers** (e.g, a home that sells for 50% higher than similar homes.)

♻️ *Why it matters:* Garbage in, garbage out.

⚙️ *Solution:* build a pipeline to identify and exclude statistical outlier sales (~7% of sample).



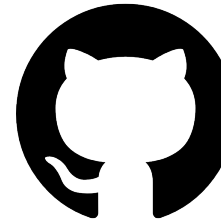
3. Better modeling

Then



38 linear models
closed-source

Now

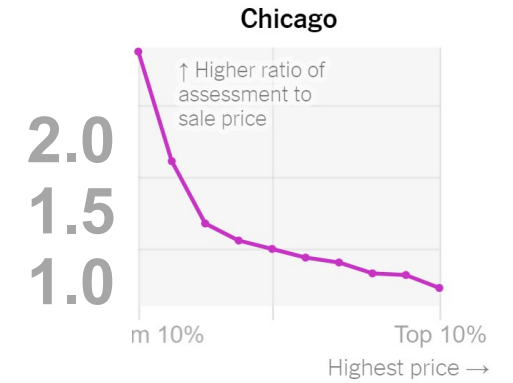
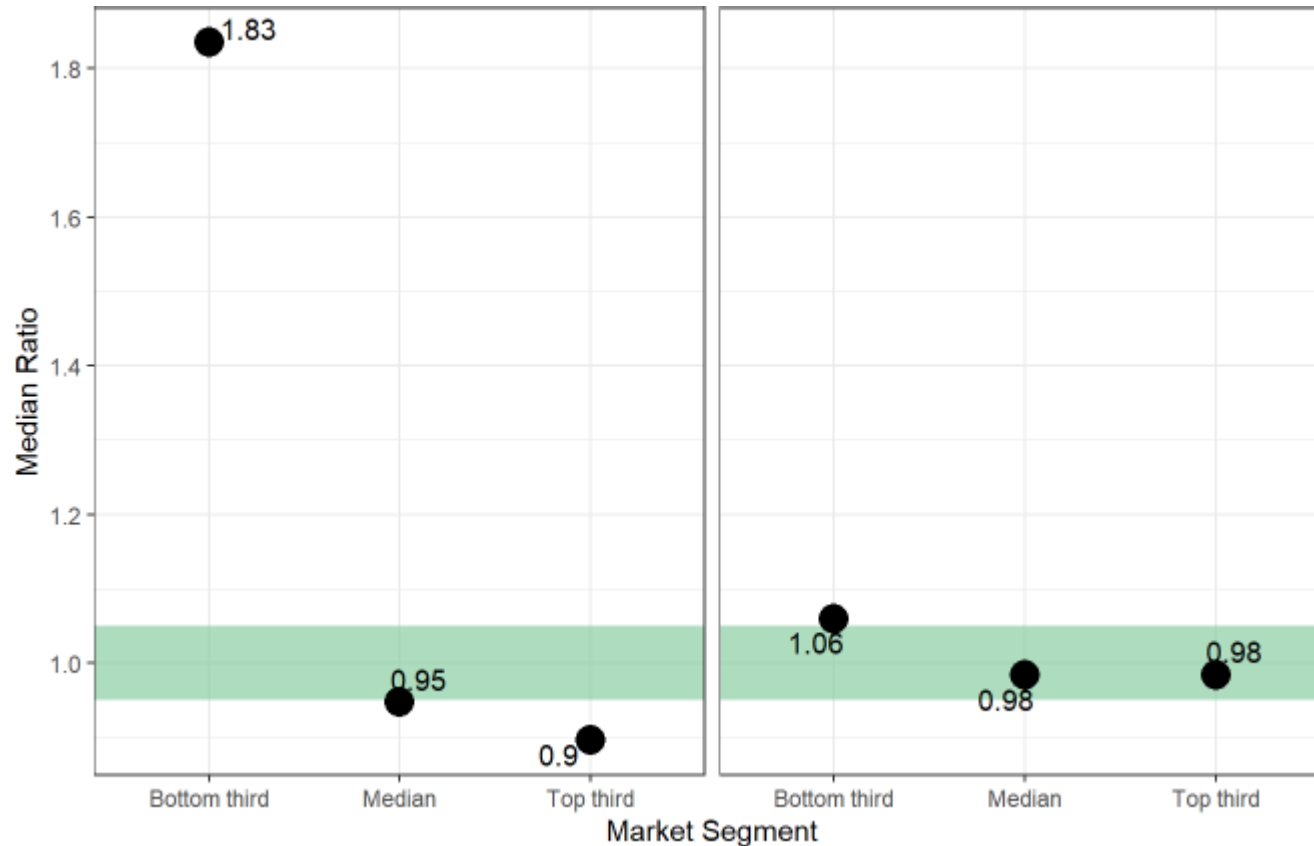


1 tree-based (LightGBM) model
open-source

Results: West Chicago

Then (2018)

Now (2021)



Are we done? Not yet...



| | |
|-------------------------------|--|
| DESCRIPTION | Two or more story residence, over 62 years, up to 2,200 sq.ft. |
| RESIDENCE TYPE | Two Story |
| USE | Single Family |
| APARTMENTS | 0 |
| EXTERIOR CONSTRUCTION | Masonry |
| FULL BATHS | 2 |
| HALF BATHS | 0 |
| BASEMENT ¹ | Full |
| ATTIC | None |
| CENTRAL AIR | Yes |
| NUMBER OF FIREPLACES | 0 |
| GARAGE SIZE/TYPE ² | None |
| AGE | 130 |
| BUILDING SQUARE FOOTAGE | 2,343 |



Data Science & Analytics: better modeling practices

- better data science → better public service
- code is policy
- we can institutionalize reform

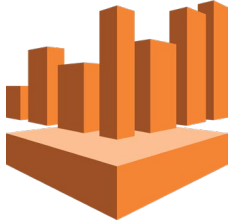
Data Science & Analytics:

better modeling practices

Data & Software Engineering:

better infrastructure, cleaner data

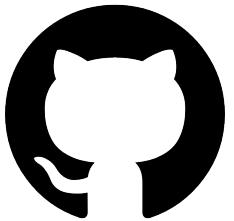
Better infrastructure



AWS Athena Serverless columnar data storage and retrieval

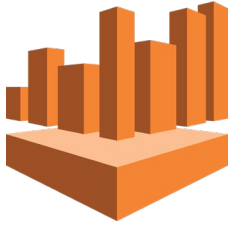


dbt Data transformation, testing, and documentation



GitHub Actions Code automation

Better infrastructure



AWS Athena Serverless columnar data storage and retrieval

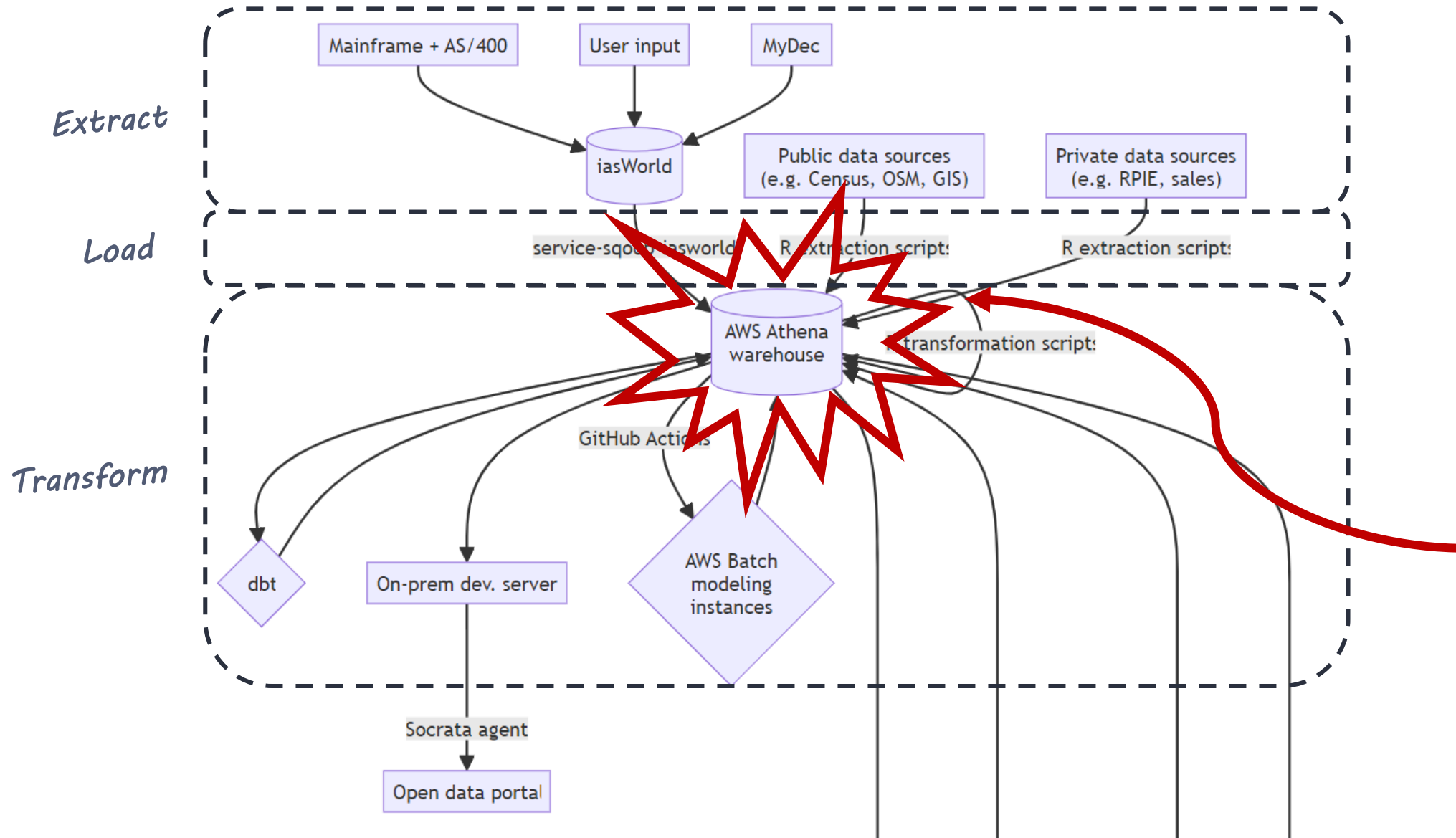


dbt Data transformation, testing, and documentation



GitHub Actions Code automation

Better infrastructure



Better infrastructure



Athena: Serverless columnar database on AWS

The screenshot shows the Amazon Athena Query editor interface. On the left, the 'Data' panel shows the 'Data source' as 'AwsDataCatalog', the 'Database' as 'census', and a list of 'Tables (5)' including 'acs1', 'acs5', 'decennial', 'table_dict', and 'variable_dict'. Below this is a 'Views (1)' section with 'vw_acs5_stat'. The main area shows a query editor with a SQL query: `SELECT * FROM "census"."acs5" limit 10;`. Below the query editor are buttons for 'Run again', 'Explain', 'Cancel', 'Clear', and 'Create'. The 'Query results' tab is active, showing a 'Completed' status with 'Time in queue: 72 ms', 'Run time: 2.208 sec', and 'Data scanned: 7.63 MB'. Below this is a 'Results (10)' section with a search bar and a table of results.

| # | geoid | b01001_001e | b01001_001m | b01001_002e | b01001_002m |
|---|---------|-------------|-------------|-------------|-------------|
| 1 | 1719320 | 74930.0 | 1110.0 | 36112.0 | 911.0 |
| 2 | 1719560 | 38230.0 | 1040.0 | 18232.0 | 798.0 |
| 3 | 1719620 | 32082.0 | 557.0 | 16065.0 | 459.0 |

Store tables as
parquet files in S3
(198 total)

Store views as
SQL queries
(46 total)

Query data
directly from S3

Pay by amount of
data scanned

Access results
through UI,
Python/R SDKs,
or Spark jobs

Taxpayer benefit



- 🕒 Saves **dev time**: No database management
- 📈 Saves **uptime**: No maintenance windows
- 💰 Saves **money**: Cheaper than managed alternatives

| Description | Usage Quantity | Amount in USD |
|---|------------------|---------------|
| Simple Storage Service | | USD 76.85 |
| US East (N. Virginia) | | USD 76.85 |
| Amazon Simple Storage Service Requests-Tier1 | | USD 18.57 |
| Amazon Simple Storage Service Requests-Tier2 | | USD 18.67 |
| Amazon Simple Storage Service TimedStorage-ByteHrs | | USD 39.61 |
| Athena | | USD 104.11 |
| US East (N. Virginia) | | USD 104.11 |
| Amazon Athena Spark_Execution | | USD 43.35 |
| 0.35 USD per DPU-Hour for CodeExecutionInDPUHours:Spark_Execution | 123.869 DPU-Hour | USD 43.35 |
| Amazon Athena USE1-DataScannedInTB | | USD 60.76 |
| 5.00 USD per Terabytes for DataScannedInTB in US East (N. Virginia) | 12.152 Terabytes | USD 60.76 |

50m requests

1.8 TB data stored

Better infrastructure



AWS Athena Serverless columnar data storage and retrieval



dbt Data transformation, testing, and documentation



GitHub Actions Code automation

Better infrastructure



dbt = Data Build Tool

Open source!



@dbt-labs/dbt-core

```
1  -- CTAS to create a table of distance to the nearest CTA stop for each PIN
2  {{
3    config(
4      materialized='table',
5      partitioned_by=['year'],
6      bucketed_by=['pin10'],
7      bucket_count=1
8    )
9  }}
10
11  WITH cta_stop AS ( -- noqa: ST03
12    SELECT *
13    FROM {{ source('spatial', 'transit_stop') }}
14    WHERE agency = 'cta'
15          AND route_type = 1
16  )
17
18  SELECT
19    pcl.pin10,
20    ARBITRARY(xy.stop_id) AS nearest_cta_stop_id,
21    ARBITRARY(xy.stop_name) AS nearest_cta_stop_name,
22    ARBITRARY(xy.dist_ft) AS nearest_cta_stop_dist_ft,
23    ARBITRARY(xy.year) AS nearest_cta_stop_data_year,
24    pcl.year
25  FROM {{ source('spatial', 'parcel') }} AS pcl
26  INNER JOIN ( {{ dist_to_nearest_geometry('cta_stop') }} ) AS xy
27    ON pcl.x_3435 = xy.x_3435
28    AND pcl.y_3435 = xy.y_3435
29    AND pcl.year = xy.pin_year
30  GROUP BY pcl.pin10, pcl.year
```

```
- name: proximity.dist_pin_to_cta_stop
  description: '{{ doc("table_dist_pin_to_cta_stop") }}'

- name: proximity.dist_pin_to_golf_course
  description: '{{ doc("table_dist_pin_to_golf_course") }}'

- name: proximity.dist_pin_to_hospital
  description: '{{ doc("table_dist_pin_to_hospital") }}'

- name: proximity.dist_pin_to_lake_michigan
  description: '{{ doc("table_dist_pin_to_lake_michigan") }}'

- name: proximity.dist_pin_to_major_road
  description: '{{ doc("table_dist_pin_to_major_road") }}'
```

```
jecochr@ccao-datals:~/data-architecture$ dbt build --select
proximity.dist_pin_to_cta_stop
```

Better infrastructure



dbt = **Data Build Tool**

Open source!



@dbt-labs/dbt-core

We use dbt for...



Continuous integration for data transformations



Data quality testing



Data documentation



@ccao-data/data-architecture

Also open source!!

Better infrastructure



 Continuous integration for data transformations

Before...

 Testing done in prod

 View changes copy/pasted from GitHub to Athena UI

 Table changes run manually

Better infrastructure



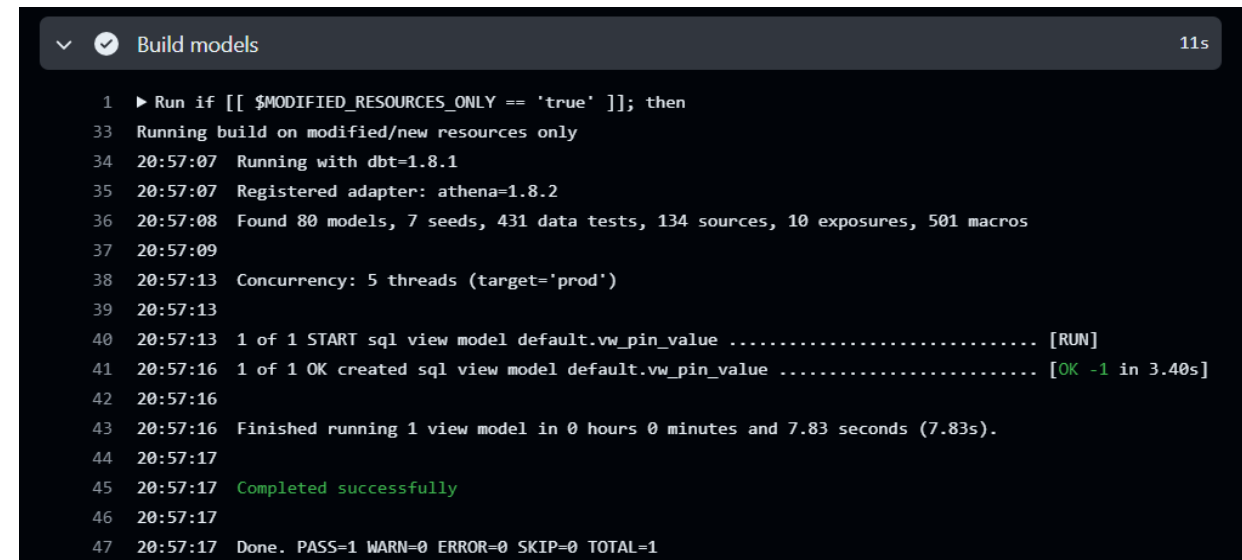
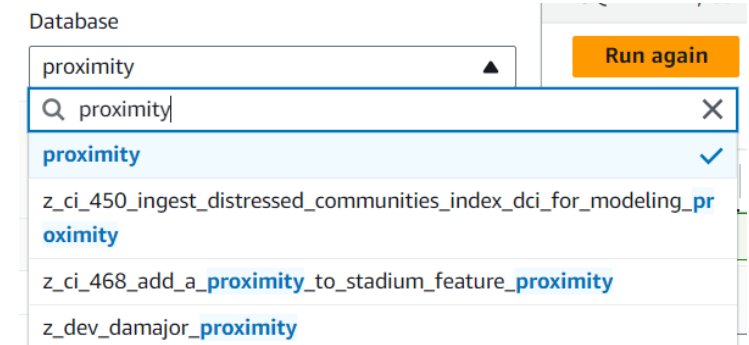
🚀 Continuous integration for data transformations

After...

💪 Dev/prod resources separated by schema prefixes

😎 New + modified resources Deployed by CI →

👍 Prod resources protected From manual editing



Better infrastructure



Data quality testing

- Data comes from vendor DB with little data validation

37 tables,
5,512 columns,
817m rows

(that we have
access to)

Parcel

Pay Year: 2025
Location: 848 N LATROBE
Bldg/Unit #:
Mult Addr: No
Unit:
City Zip: CHICAGO 60651
NBHD: 77013-77013
Class: 205 - 205
Use Code: 205 -
Deeded Acres
Deeded SF
Plat/Park#
Plat/Park Name
Lot
Block
Section-Twp-Range
Tax District: 77001 -
Town/City: 77 - West Chica
School: 544 - 544
Fire: 00001 - 00001
TIF Project #:

Parcel Status

In Forfeiture: No
COJ: No
In Bankruptcy
Mortgage Company-
ACH: No
MH Court
Agreement
Cash Only
Delinquent
Homestead: N - Non-Homes

Parcel Permits Sales Field Inspection Land **Dwellings** Additions OBY Alt. Addr Com Bldgs Com Int/Ext Com Features Values Owners Legal Asmt IE Survey Assessor Notes

| Card# | Class | Style | Eff Year | Year Built | Qual | SFLA | RCNLD | Who | When | Whocalc | Whencalc | Record | Status |
|-------|-------|-------|----------|------------|------|-------|-----------|--------|---------------------|---------|---------------------|---------|--------|
| 1 | 205 | 5 | | 1894 | 2 | 2,343 | \$227,664 | MVILLA | 02/23/2024 10:56 AM | CA405 | 05/20/2024 02:37 PM | Current | |

Residential Characteristics

1. Residence Type: 2: TWO STORY
2. Residence Use: 1: SINGLE FAMILY
3. Total Number of Units: 6: NONE
4. Exterior Walls: 2: MASONRY
5. Roof: 2: TAR & GRAVEL
6. Number of Rooms: 8
7. Number of Bedrooms: 4
8. Number of Full Baths: 2
9. Number of Half Baths: 0
10. Basement: 1: FULL
11. Basement Finish: 1: FAMILY ROOM
12. Central Heating: 1: WARM AIR
13. Other Heating:
Solar: ☐
Heating Stove: ☒
Unit Heater: ☐
Floor Furnace: ☐
14. Central Air Conditioning: 1: YES
16. Attic Type: 3: NONE
17. Attic Finish: 3: UNFINISHED
18. Plan of Design: 2: STOCK PLAN
19. Construction Quality: 2: AVERAGE
20. Renovated: 0: NO
21. State Of Repair: 2: AVERAGE
22. Site Desirability: 2: NOT RELEVANT TO VALUE
23. Garage Size: 7: NONE
Construction: 0
Attached: 2: NO
In Area: 2: NO
24. Porch: 0: NONE
25. Roof Top Deck:
26. Sq ft of Living Area: 2,343

Better infrastructure



Data quality testing

- Data comes from vendor DB with little data validation
- We define tests on dbt source definitions

433 tests



```
926 - name: sfla
927   description: '{{ doc("shared_column_char_bldg_sf") }}'
928   data_tests:
929     - not_null:
930       name: iasworld_dweldat_sfla_not_null
931       additional_select_columns: *select-columns
932       config: *unique-conditions
933       meta:
934         description: sfla (Building Square Footage) should not be null
935     - accepted_range:
936       name: iasworld_dweldat_sfla_between_1_and_2200_for_class_205
937       min_value: 1
938       max_value: 2200
939       additional_select_columns: *select-columns-with-class
940       config:
941         where: |
942           CAST(taxyr AS int) BETWEEN
943             {{ var('test_qc_year_start') }} AND {{ var('test_qc_year_end') }}
944           AND cur = 'Y'
945           AND deactivat IS NULL
946           AND class = '205'
947       meta:
948         description: >
949           sfla (Building Square Footage) should be between
950           1 and 2200 for class 205 cards
```

Better infrastructure



Data quality testing

- Data comes from vendor DB with little data validation
- We define tests on dbt source definitions
- Python script parses test results for output to Excel

| | A | B | E | F | I | AL |
|-------|---------------------------------------|---|---|----------------|-------|------|
| 1 | Test description fields | | Unique identifier fields | | | |
| 2 | These fields identify a failing test. | | These fields identify the row that failed | | | |
| 3 | source_table | description | taxyr | parid | class | sfla |
| 10903 | dwelddat | sfla should be between 1 and 2200 for class 205 cards | 2024 | 16043300200000 | 205 | 2343 |
| 10918 | dwelddat | sfla should be between 1 and 2200 for class 205 cards | 2024 | 16013160100000 | 205 | 2670 |
| 10927 | dwelddat | sfla should be between 1 and 2200 for class 205 cards | 2024 | 16041000220000 | 205 | 2881 |
| 10950 | dwelddat | sfla should be between 1 and 2200 for class 205 cards | 2024 | 16041100390000 | 205 | 2569 |
| 10954 | dwelddat | sfla should be between 1 and 2200 for class 205 cards | 2024 | 16043000160000 | 205 | 2357 |

```
data-architecture / .github / scripts / transform_dbt_test_results.py
Code Blame 1241 lines (1103 loc) · 48.4 KB · ⓘ
678
679 ✓ def main() -> None:
680     """Entrypoint to this script. Parses dbt test results and writes artifacts
681     to the output directory with metadata about tests."""
682     try:
683         run_results_filepath = sys.argv[1]
684     except IndexError:
685         run_results_filepath = os.path.join("target", "run_results.json")
686
687     try:
688         manifest_filepath = sys.argv[2]
689     except IndexError:
690         manifest_filepath = os.path.join("target", "manifest.json")
691
692     date_today = datetime.datetime.today().strftime("%Y-%m-%d")
693     try:
694         output_directory = sys.argv[3]
695     except IndexError:
696         output_directory = f"qc_test_results_{date_today}"
697
698     test_cache_path = get_test_cache_path(
699         run_results_filepath,
700         manifest_filepath,
701     )
702
```

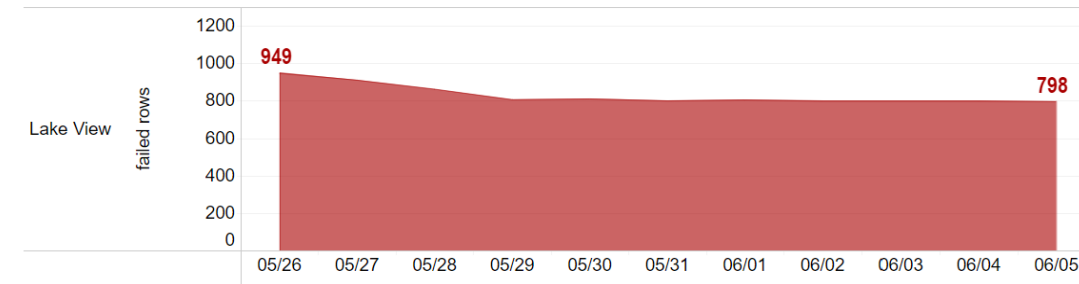

Better infrastructure



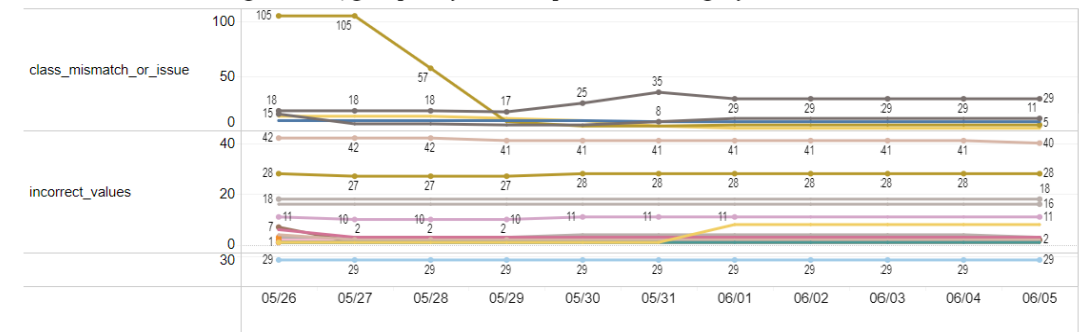
Data quality testing

- Data comes from vendor DB with little data validation
- We define tests on dbt source definitions
- Python script parses test results for output to Excel
- Tableau dashboard displays test failures over time

Total Failures in Selected Township: [Lake View](#)



Number of rows failing QC tests, grouped by Township then test category



Better infrastructure



Data quality testing

- Data comes from vendor DB with little data validation
- We define tests on dbt source definitions
- Python script parses test results for output to Excel
- Tableau dashboard displays test failures over time
- Eventually: Automate tests, catch errors in real time

Better infrastructure



Data documentation

```
447
448 ▼ ## char_bldg_sf
449
450 {% docs shared_column_char_bldg_sf %}
451 Square footage of the building, as measured from the exterior.
452 {% enddocs %}
453
454 ▼ ## char_bldg_is_mixed_use
455
456 {% docs shared_column_char_bldg_is_mixed_use %}
457 The 10-digit PIN (building) contains a 14-digit PIN that is
458 neither class 299 nor 399.
459
460 Applies to condos only
461 {% enddocs %}
```



iasworld.dweldat source table

[Details](#) [Description](#) [Columns](#) [Referenced By](#) [SQL](#)

| COLUMN | TYPE | DESCRIPTION | CONSTRAINTS |
|--------|--------------|-------------|-------------|
| sfla | decimal(9,0) | | |

Details

Description

Square footage of the building, as measured from the exterior.

Generic Data Tests

Not Null

Taxpayer benefits



Continuous integration 👉 Faster and safer iteration

39 PRs merged last month



QC testing 👉 Fewer data errors that cause incorrect values

194 rows fixed last month



Data documentation 👉 More durable knowledge, fewer mistakes

3,733 columns, tables,
and tests documented

Better infrastructure



AWS Athena Serverless columnar data storage and retrieval



dbt Data transformation, testing, and documentation



GitHub Actions Code automation

Better infrastructure



The screenshot shows the GitHub Actions interface for the repository 'ccao-data / data-architecture'. The left sidebar lists various workflows, including 'build-and-test-dbt', 'build-daily-dbt-models', 'cleanup-dbt-resources', 'deploy-dbt-dependencies', 'deploy-dbt-docs', 'pre-commit', 'super-linter', 'test-dbt-models', 'test-dbt-source-freshness', and 'test-open-data-assets'. The main area displays 'All workflows' with a search bar and a table of workflow runs. A white circle highlights the text '7,340 workflow runs' in the table header, with an arrow pointing to it from the text 'One year's worth of workflow runs' on the right. The table lists several runs, including 'First draft of sales script' and 'deploy-dbt-docs', with their respective statuses, event names, and completion times.

| Workflow | Status | Event | Branch | Actor | Time |
|-----------------------------|---------|--|-------------------|--------------|----------------|
| First draft of sales script | Success | super-linter #1971: Pull request #496 opened by wrridgeway | 387-reporting-sot | wrridgeway | 47 minutes ago |
| First draft of sales script | Success | pre-commit #1992: Pull request #496 opened by wrridgeway | 387-reporting-sot | wrridgeway | 47 minutes ago |
| First draft of sales script | Failure | build-and-test-dbt #1968: Pull request #496 opened by wrridgeway | 387-reporting-sot | wrridgeway | 47 minutes ago |
| deploy-dbt-docs | Success | deploy-dbt-docs #306: completed by jeancochrane | | jeancochrane | 1 hour ago |

One year's
worth of
workflow runs

Better infrastructure



Actions

All workflows

build-and-test-dbt

build-daily-dbt-models

cleanup-dbt-resources

deploy-dbt-dependencies

deploy-dbt-docs

pre-commit

super-linter

test-dbt-models

test-dbt-source-freshness

test-open-data-assets

Build and unit test tables and views
Deploy Python dependencies for Spark
Deploy dbt docs

On commits

On PR close

Clean up staging resources

Scheduled daily




Refresh tables
Run QC tests
Run source freshness tests
Run open data asset tests

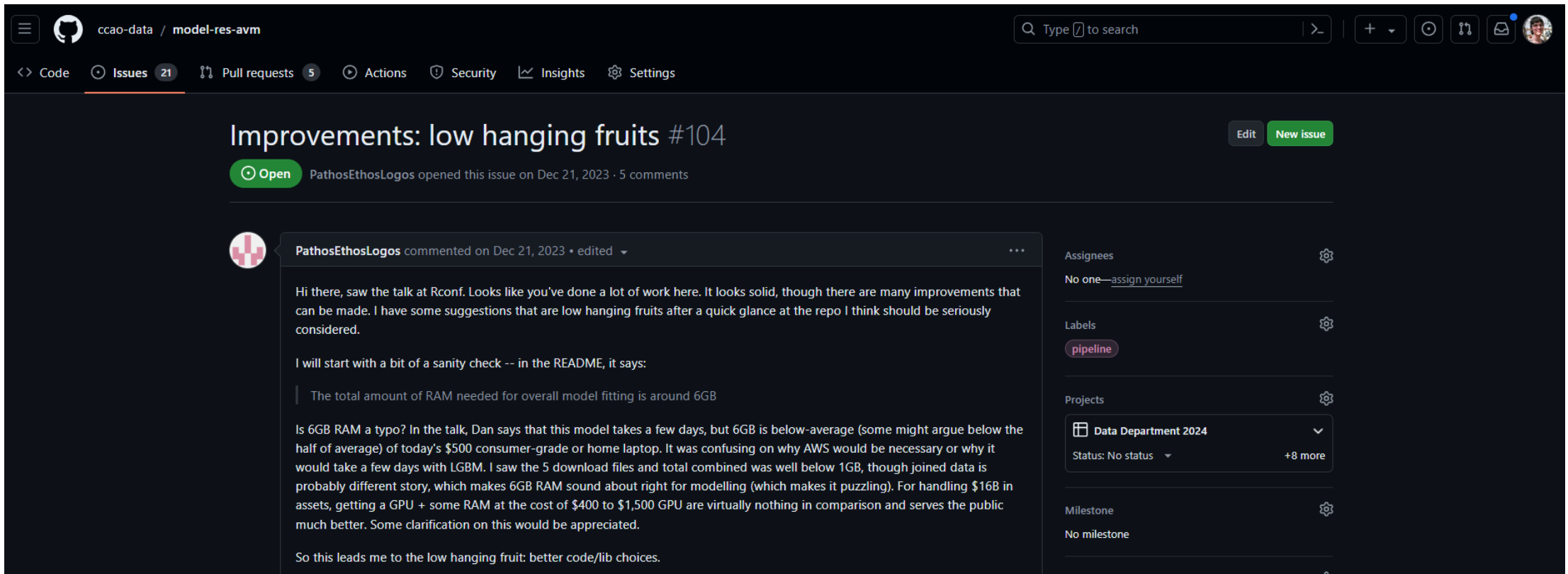
On dispatch

Build and run model
Delete model runs
Tag model runs

Taxpayer benefits



-  Saves **time**: Work on hard modeling problems, automate the rest
-  Saves **money**: All features we use are on the free tier
-  Builds **trust**: Most of our work is public and consolidated on one platform

A screenshot of a GitHub issue page for the repository "ccao-data / model-res-avm". The issue title is "Improvements: low hanging fruits #104". It was opened by "PathosEthosLogos" on Dec 21, 2023, and has 5 comments. The issue is currently open. A comment from "PathosEthosLogos" is visible, discussing the need for more RAM (6GB) for model fitting and suggesting improvements to the README. The right sidebar shows the issue's metadata, including assignees (none), labels (pipeline), projects (Data Department 2024), and milestones (none).

ccao-data / model-res-avm

Search Type to search

<> Code Issues 21 Pull requests 5 Actions Security Insights Settings

Improvements: low hanging fruits #104

Edit New issue

Open PathosEthosLogos opened this issue on Dec 21, 2023 · 5 comments

PathosEthosLogos commented on Dec 21, 2023 · edited

Hi there, saw the talk at Rconf. Looks like you've done a lot of work here. It looks solid, though there are many improvements that can be made. I have some suggestions that are low hanging fruits after a quick glance at the repo I think should be seriously considered.

I will start with a bit of a sanity check -- in the README, it says:

The total amount of RAM needed for overall model fitting is around 6GB

Is 6GB RAM a typo? In the talk, Dan says that this model takes a few days, but 6GB is below-average (some might argue below the half of average) of today's \$500 consumer-grade or home laptop. It was confusing on why AWS would be necessary or why it would take a few days with LGBM. I saw the 5 download files and total combined was well below 1GB, though joined data is probably different story, which makes 6GB RAM sound about right for modelling (which makes it puzzling). For handling \$16B in assets, getting a GPU + some RAM at the cost of \$400 to \$1,500 GPU are virtually nothing in comparison and serves the public much better. Some clarification on this would be appreciated.

So this leads me to the low hanging fruit: better code/lib choices.

Assignees

No one—[assign yourself](#)

Labels

pipeline

Projects

Data Department 2024

Status: No status +8 more

Milestone

No milestone

Better infrastructure

Putting it all together: What's the impact of bad data?

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
|-------|--------------------|----------------------------|------------|-----------------------|----------------|------------------------|---------------------------------------|--------|-------------|----------|------------|------------|------------|---------------------------|
| 1 | | 2024-02-06-relaxed-tristan | | | | | | | | | | | | |
| 3 | | | | | | | Top 10 Most Important Model Variables | | | | | | | |
| 4 | meta_pin | meta_c | meta_class | pred_card_initial_fmv | | | meta_t | meta_r | char_bldg_ | char_fb | char_yrblt | char_land_ | char_frpl | loc_school_elementary_di |
| 5 | PIN | Card | Class | Original Prediction | API Prediction | Rounded API Prediction | Town | Nbhd | Bldg. Sqft. | F. Baths | Year Built | Land Sqft. | Fireplaces | Elementary District GEOID |
| 20185 | 16-04-330-020-0000 | 1 | 205 | \$276,152 | | | 77 | 77013 | 843 | 2 | 1894 | 3528 | 0 | 609975 |
| 20186 | 16-04-330-021-0000 | 1 | 205 | \$198,675 | | | 77 | 77013 | 1752 | 2 | 1908 | 3150 | 0 | 609975 |
| 20187 | 16-04-330-022-0000 | 1 | 205 | \$196,718 | | | 77 | 77013 | 1752 | 2 | 1908 | 3150 | 0 | 609975 |
| 20188 | 16-04-330-023-0000 | 1 | 211 | \$200,977 | | | 77 | 77013 | 1763 | 2 | 1893 | 4725 | 0 | 609975 |
| 20189 | 16-04-330-024-0000 | 1 | 206 | \$323,456 | | | 77 | 77013 | 2348 | 2 | 1888 | 4725 | 0 | 609975 |
| 20190 | 16-04-330-025-0000 | 1 | 205 | \$222,424 | | | 77 | 77013 | 2156 | 1 | 1898 | 4725 | 0 | 609975 |
| 20191 | 16-04-330-026-0000 | 1 | 205 | \$185,047 | | | 77 | 77013 | 1828 | 2 | 1893 | 1575 | 0 | 609975 |
| 20192 | 16-04-330-027-0000 | 1 | 205 | \$203,473 | | | 77 | 77013 | 1828 | 2 | 1893 | 3150 | 0 | 609975 |
| 20193 | 16-04-330-028-0000 | 1 | 205 | \$211,909 | | | 77 | 77013 | 2112 | 1 | 1893 | 4095 | 0 | 609975 |
| 20194 | 16-04-330-030-0000 | 1 | 211 | \$241,766 | | | 77 | 77013 | 2022 | 2 | 1908 | 3150 | 0 | 609975 |
| 20195 | 16-04-330-031-0000 | 1 | 211 | \$351,889 | | | 77 | 77013 | 4126 | 4 | 1913 | 4725 | 0 | 609975 |
| 20196 | 16-04-330-032-0000 | 1 | 212 | \$375,279 | | | 77 | 77013 | 5280 | 6 | 1916 | 3601 | 0 | 609975 |
| 20197 | 16-04-330-035-0000 | 1 | 212 | \$201,372 | | | 77 | 77013 | 2600 | 4 | 1916 | 3200 | 0 | 609975 |
| 20198 | 16-04-330-040-0000 | 1 | 212 | \$206,213 | | | 77 | 77013 | 2822 | 3 | 1901 | 3121 | 0 | 609975 |
| 20199 | 16-04-331-001-0000 | 1 | 211 | \$341,460 | | | 77 | 77013 | 4248 | 4 | 1913 | 3150 | 0 | 609975 |
| 20200 | 16-04-331-003-0000 | 1 | 211 | \$247,267 | | | 77 | 77013 | 2394 | 2 | 1903 | 4725 | 0 | 609975 |
| 20201 | 16-04-331-004-0000 | 1 | 205 | \$185,155 | | | 77 | 77013 | 1248 | 1 | 1903 | 4725 | 0 | 609975 |
| 20202 | 16-04-331-005-0000 | 1 | 211 | \$226,464 | | | 77 | 77013 | 2208 | 2 | 1898 | 1575 | 0 | 609975 |
| 20203 | 16-04-331-006-0000 | 1 | 211 | \$247,208 | | | 77 | 77013 | 2208 | 2 | 1898 | 3150 | 0 | 609975 |
| 20204 | 16-04-331-007-0000 | 1 | 211 | \$274,348 | | | 77 | 77013 | 2082 | 2 | 1894 | 3150 | 0 | 609975 |

Thank you! Questions?

Links

 [@ccao-data/data-architecture](#)

ELT and data lake repo

 [@ccao-data/model-res-avm](#)

Residential model repo

 [@ccao-data/model-condo-avm](#)

Condo model repo

 [ccao-data.github.io/data-architecture](#)

Data documentation

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Team email address