

Politics Ain't Beanbag: Using APEX, ML, and GeoCoding In a Modern Election Campaign



November 16, 2020

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Zero Defect Computing, Inc.

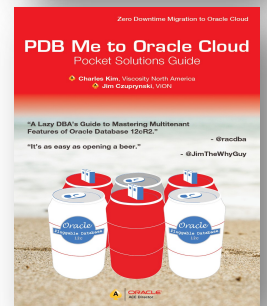
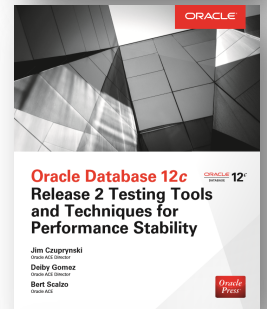
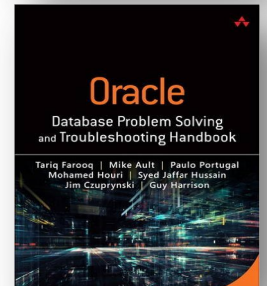
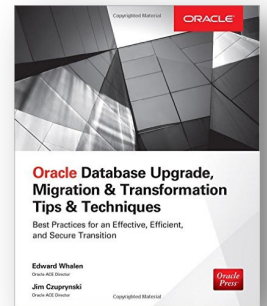
My Credentials



- 40 years of database-centric IT experience
- Oracle DBA since 2001
- Oracle 9i, 10g, 11g, 12c OCP and ADWC
- Oracle ACE Director since 2014
- ODTUG Database Committee Lead
- Editor of ODTUG *TechCeleration*
- Oracle-centric blog (Generally, It Depends)
- Regular speaker at Oracle OpenWorld, COLLABORATE, KSCOPE, and international and regional OUGs

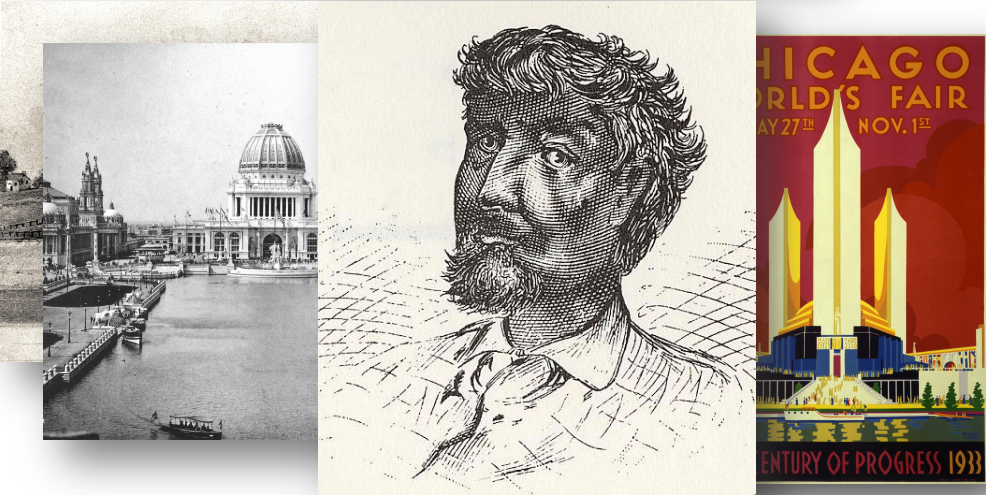


- E-mail me at jczuprynski@zerodefektcomputing.com
- Follow me on Twitter (@JimTheWhyGuy)
- Connect with me on LinkedIn (Jim Czuprynski)



So ... What Does the Title Really Mean?

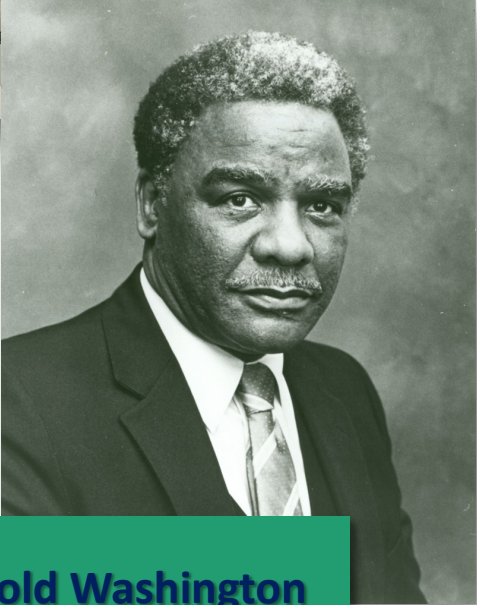
Bean bag
(also known as **cornhole**)



Politics ain't bean-bag.
- Dunne's "Mr. Dooley"



Finley Peter Dunne



Harold Washington

ATP, Machine Learning, and APEX: Benefits and Synergies

APEX, AI, and ML: Where Analytic Magic Happens

Application Express (APEX) makes it trivial to instantly **import data** and **business applications** directly into Oracle ... even if it's just resident within a simple **spreadsheet**

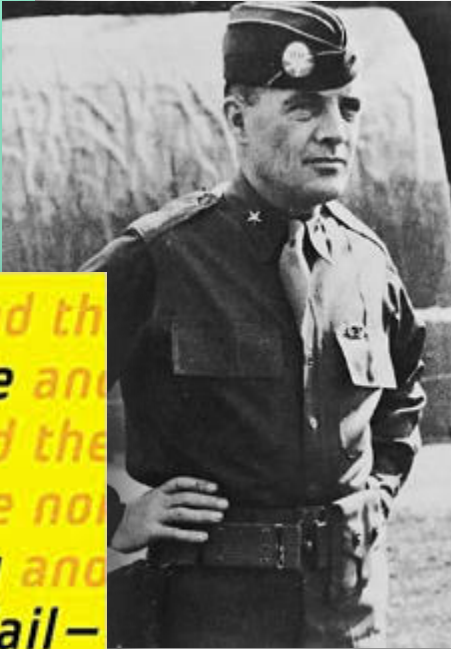
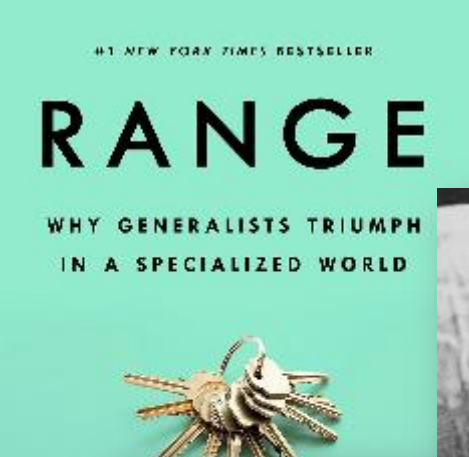


Once relevant data is captured, Oracle's **built-in data mining tools** make is simple to **build data models**, apply well-known **algorithms**, and obtain **predictions for immediate business insights**



Oracle's **REST API** enables quick development of **complex data entry and reporting applications** within APEX in a **low-code environment**

Specialization Is Dead. Long Live the Generalist.



the signal and the
and the noise and
the noise and the
noise and the no
why so many and
predictions fail—
but some don't t
and the noise and
the noise and the
nate silver noise
noise and the no

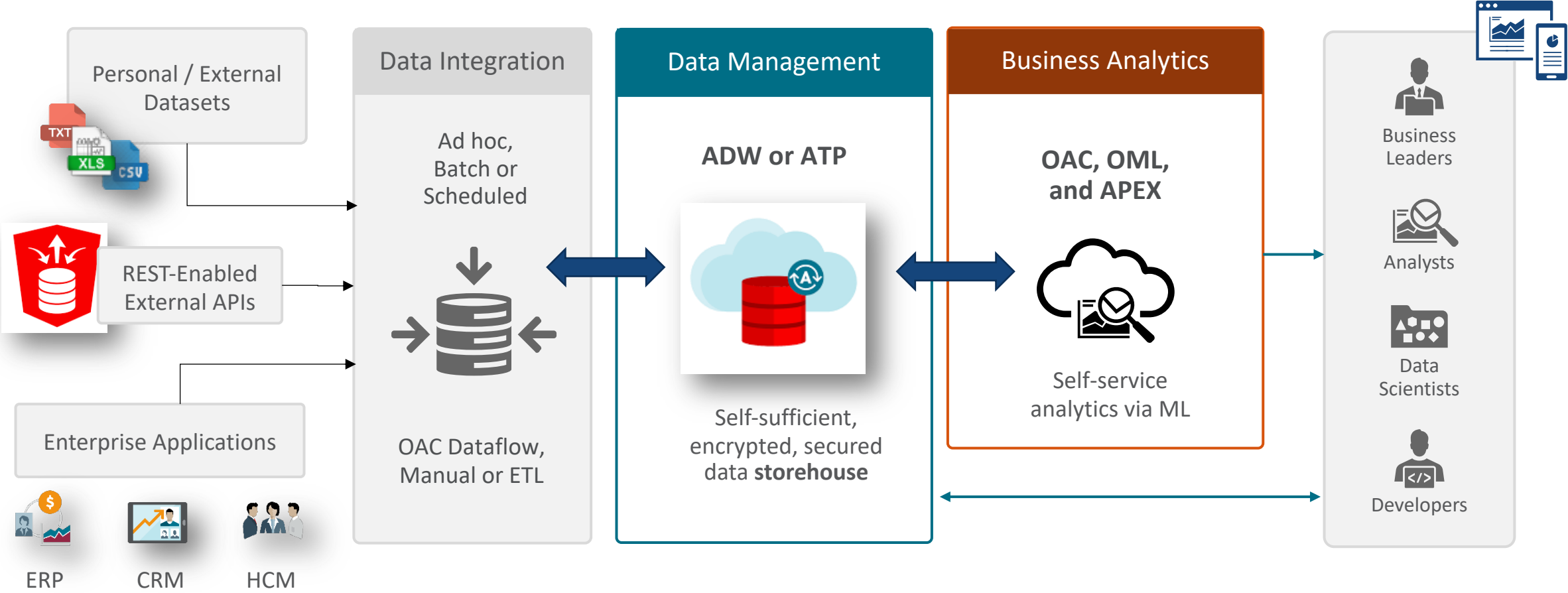
Compared to other scientists, Nobel laureates are *at least twenty-two times more likely* to partake as an amateur actor, dancer, magician, or other type of performer.
- David J. Epstein. Range (p. 33).

“We now have the [enemy] exactly where we want them. *We can now attack in any direction.*”
- Brigadier General Anthony C. “Nuts” McAuliffe

Data is the new oil, and its miners are data scientists ... but DBAs are *uniquely positioned* to support them

All images from images.google.com

The Converged Database: A Vision for the Future, 20c and Beyond



VEVO 2.0: (Re)building the APEX Application Framework

- **VEVO 1.0:** My “Hello World!” APEX Application
- **VEVO 2.0:** A New Campaign. New Requirements.

VEVO 1.0: An (Extremely!) Basic Desktop Application



- Campaign organization *management*



- Canvassing *progress*

- Campaign organization staff's *hierarchy*



- Canvassing *coverage* within geographic areas

VEVO Desktop: Campaign Overviews, Drill-Downs, and Details

1 Reviewing voter canvassing progress

Voters Save

Search: All Text Columns Go Actions Edit

Search for 'czupryna' x

<input type="checkbox"/>	<input type="checkbox"/>	Last Name	First Name	Gender
<input type="checkbox"/>	<input type="checkbox"/>	Czupryna	Leilani	M
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Czupryna	Markus	F
<input type="checkbox"/>	<input type="checkbox"/>	Czupryna	Luanne	F
<input type="checkbox"/>	<input type="checkbox"/>	Czupryna	Lahoma	M

1 rows selected

Canvassing History

Search: All Text Columns Go Actions Edit Add Row Reset

<input type="checkbox"/>	<input type="checkbox"/>	Canvassed On	Canvass Type	Affinity	Enthusiasm	Might Volunteer?	Might Cont...	Follow Up?	Do Not ...	Comments
<input checked="" type="checkbox"/>	<input type="checkbox"/>	2018-06-02	Campaign Ev...	2-Negative	3-Neutral	Yes	Yes	No	No	Generally positive
<input type="checkbox"/>	<input type="checkbox"/>	2018-06-28	Campaign Ev...	3-Neutral	1-Very Negative	No	Yes	No	No	Not voting
<input type="checkbox"/>	<input type="checkbox"/>	2018-06-20	Campaign Ev...	3-Neutral	1-Very Negative	No	Yes	Yes	No	Threatened us on porch
<input type="checkbox"/>	<input type="checkbox"/>	2018-08-27	Campaign Ev...	3-Neutral	4-Positive	No	Yes	No	No	No opinion
<input type="checkbox"/>	<input type="checkbox"/>	2018-08-21	Campaign Ev...	4-Positive	3-Neutral	No	Yes	Yes	No	No opinion
<input type="checkbox"/>	<input type="checkbox"/>	2018-09-28	Campaign Ev...	3-Neutral	3-Neutral	No	Yes	No	No	Positive
<input type="checkbox"/>	<input type="checkbox"/>	2018-07-16	E-Mail	4-Positive	4-Positive	No	Yes	No	No	No opinion
<input type="checkbox"/>	<input type="checkbox"/>	2018-07-30	E-Mail	2-Negative	2-Negative	No	Yes	Yes	No	Not voting
<input type="checkbox"/>	<input type="checkbox"/>	2018-08-19	Home	1-Very Negat...	5-Very Positive	No	Yes	Yes	No	Generally positive
<input type="checkbox"/>	<input type="checkbox"/>	2018-10-10	Home	2-Negative	2-Negative	No	Yes	Yes	No	No opinion
<input type="checkbox"/>	<input type="checkbox"/>	2018-08-28	Home	2-Negative	4-Positive	No	Yes	No	No	No opinion
<input type="checkbox"/>	<input type="checkbox"/>	2018-07-02	Home	3-Neutral	3-Neutral	No	Yes	Yes	Yes	Not voting

1 rows selected Total 30

VEVO Desktop: Campaign Overviews, Drill-Downs, and Details

Not only does this provide the hierarchical structure of the staff ...



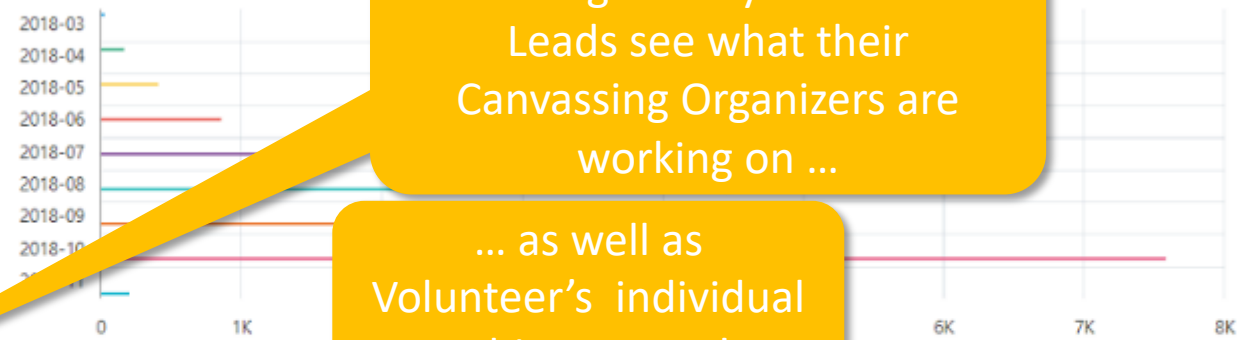
... and Canvassing Organizers can review the combined results of her team ...

Progress Report for Campaign Organizer: **Champion, Priscilla**

Campaign Organizer	Avg Contribution
Champion, Priscilla	
Thomason, Tim	34901
Jordan, Antonio	15488

[Download](#)

Canvassing Summary Within Months for Canvassing Organizer: **Champion, Priscilla**



... but it gives key Committee Leads see what their Canvassing Organizers are working on ...

... as well as Volunteer's individual achievements!

Progress Report for Campaign Organizer: **Champion, Priscilla**

Volunteer: **Martinez, Joseph**

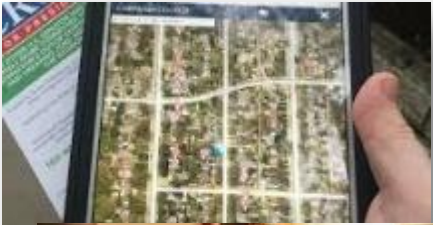
Volunteer Name	Voters Canvassed	Avg Affinity	Avg Enthusiasm	Avg Volunteerism	Avg Contributionism	Avg Followup
Martinez, Joseph	6319	3.01	2.99	.33	.78	.61

[Download](#)

Avg Followup
.61
.63
.61

1 - 3

MobileVEVO: Deploying A Basic Mobile Application



Canvassers in the field needed to:

- Find which voters haven't *yet been canvassed*
- See voters' details while canvassing
- Record *voter sentiment* towards candidate
- Mark off voters *already contacted*

MobileVEVO: Easy to Build. Easy to Use.

- 1 The canvasser self-assigns ...
- 2 .. and gets assigned a random list of voters to canvass ...
- 3 ... and then the canvasser records detailed information about the voter's proclivities towards the candidate and campaign.

MobileVEVO

Canvassing Assignments

MobileVEVO

Canvassing Assignments

Change Volunteer

Volunteer Name
Alexander

NGP VAN ID	Precinct ID	Voter Name	Street Address
40624	BA0002	Breashears, Kevin	941 Walnut Blvd.
105624	VI0001	Hochard, Damon	256 Lincoln Blvd.
210124	PL0001	Fulgham, Breanne	27 Oak Blvd.
244624	EL0001	Rosenheim, Verda	533 Maple Blvd.
279624	EL0002	Osby, Lyndon	49 Third Ave.

MobileVEVO

Canvassing Assignments

Record Your Canvassing Results

Record Activity Cancel

Voter:
Hochard

* Canvassed On: 2018-11-01

* Location: Referral

* Candidate Affinity: 1-Very Negative 2-Negative 3-Neutral 4-Positive 5-Very Positive

* Enthusiasm Rating: 1-Very Negative 2-Negative 3-Neutral 4-Positive 5-Very Positive

* Interested in Volunteering?: No Yes

* Interested in Contributing \$?: No Yes

* Follow-Up Suggested?: No Yes

* Do Not Recontact?: No Future Contact OK to Contact

* Comments: Excited about campaign and possible results!

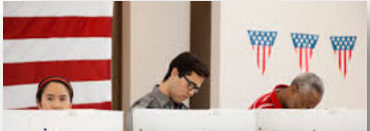
VEVO 2.0: A New Election Campaign, With Some New Requirements



Identify potential voters, including “flippability” since 2018 election

Deploy multitudes of volunteers for maximum efficiency

Analyze results of voter outreach



VEVO 2.0: Perfect for Autonomous DB Always-Free.



- **Centralized** data management, **consistent** processes
- **Simple** data model, **smallish** data volume
- **Machine Learning, Analytics,** and **GIS** features are **crucial**
- Security is a *must!*



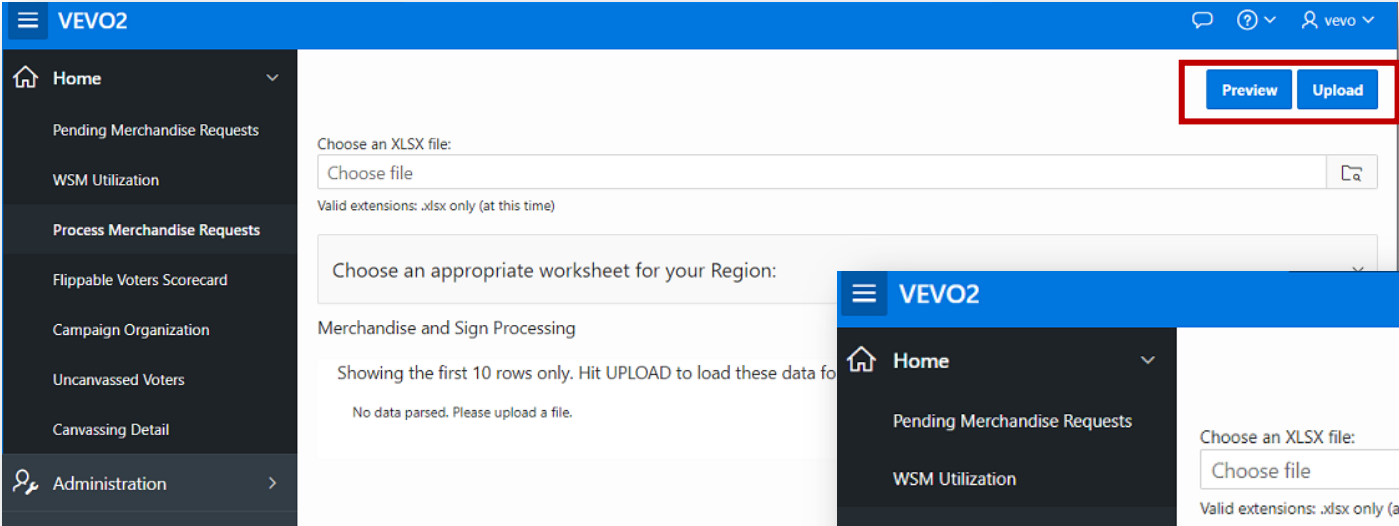
*Just because you're **paranoid**
doesn't mean **they're not out to get you.***

- Anonymous

Bringing Code to Data, Not the Other Way Around

- Loading Data from External Sources with APEX_DATA_PARSER
- Leveraging Web Source Modules

Capturing Campaign Merchandising Data From External Sources

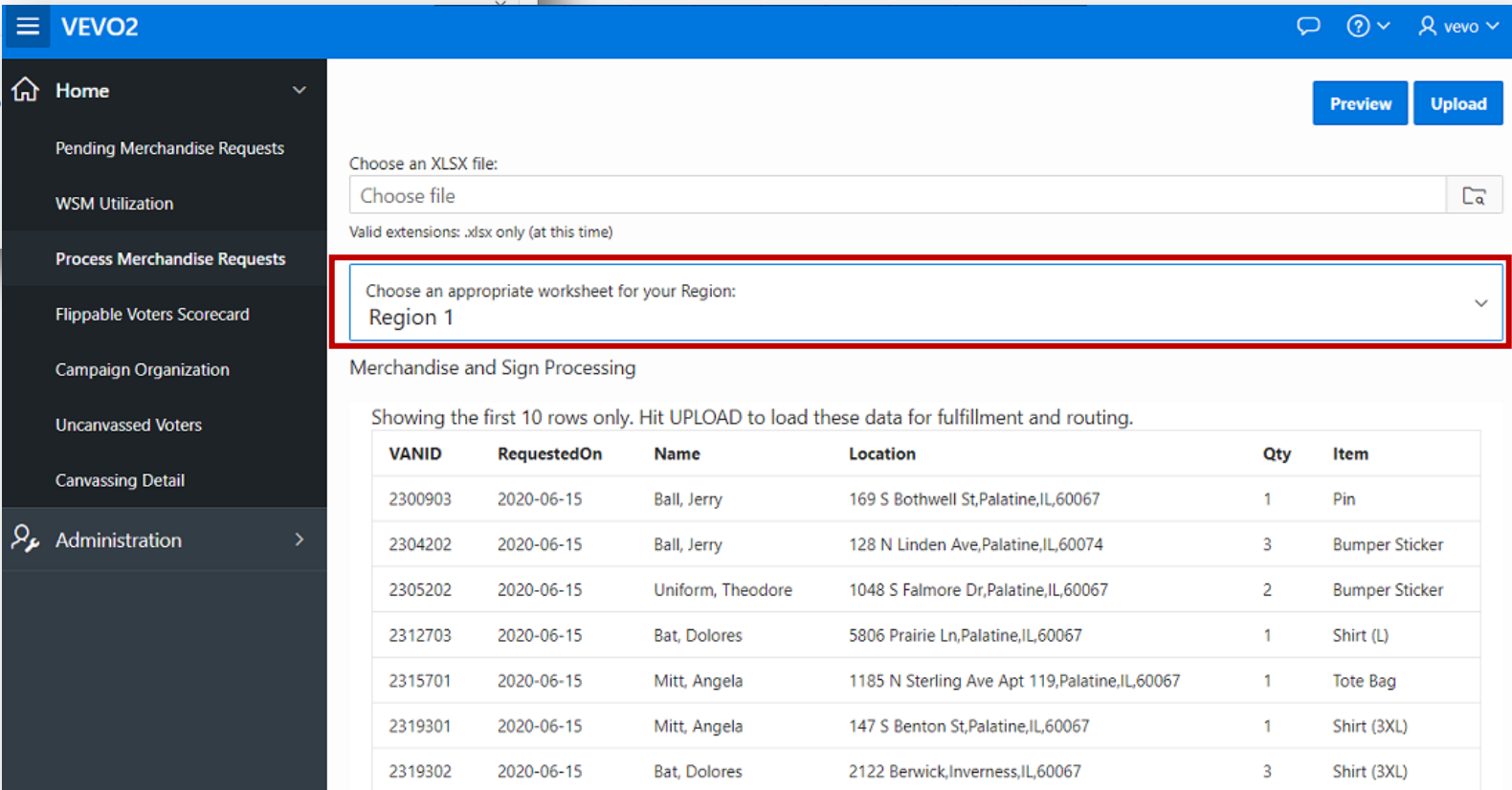


1

This page allows **retrieval, review,** and eventual **loading** of data stored within Microsoft Excel spreadsheets

2

If there are more than one sheets in the incoming XLSX workbook, each sheet's contents can be processed **separately**



Web Source Modules: Leave the Data Where It Lives

1

Web Source Modules let you access **vast amounts** of external data via **REST API calls**

3

The REST API call requires an **API key**, as well as a **compressed, single field version** for each address to retrieve **Latitude, Longitude, and other specific GIS information** for a single address

The screenshot displays the Oracle APEX Web Source Modules interface. On the left, a table lists various modules, with 'MQSingleAddress' highlighted in a red box. On the right, a detailed configuration window for 'MQSingleAddress' is shown, also with a red box highlighting the 'Module Parameters' section.

Module Name	Updated	Operations	Authentication Required	Remote Server Name	Endpoint URL
BingAddresses	2 weeks ago	1	No	MQ Single Address Request	https://www.mapquestapi.com/
BatchIt	13 hours ago	1	No	Geocodio	https://api.geocod.io/v1.6/geocod
Geocodio Batch Geocoding	3 days ago	1	No	Geocodio	https://api.geocod.io/v1.6/geocod
FEC Contributions	3 days ago	1	No	api-open-fec-gov-v1-elections	https://api.open.fec.gov/v1/election
IL Statistics	3 months ago	1	No	data-illinois-gov-api-3	https://data.illinois.gov/api/3/a
MQSingleAddress	3 days ago	1	No	MQ Single Address Request	https://www.mapquestapi.com/

Name	Type	Direction	Default Value	Required	Use for Row Search
key	Query String variable	In	I7zJHAWYGe82G9BdPIDaFgf41v4AEdNt	No	No
location	Query String variable	In	318 Pebble Beach Lane,Bartlett,IL,60103	No	No

Implementing a Web Source Module

```
DECLARE
    wsm_cor
    wsm_par

    l_locid
    l_gisid
    l_latic
    l_lngid
    l_sosid

    vcGISQu
    nLatitu
    nLongit
    vcLocat
    vcSideC
    . . .
BEGIN
    -- Describe
    APEX_EXEC.A
        p_parame
        ,p_name
        ,p_value

    -- Open Web
    wsm_context
    APEX_EXEC
        p_module
        ,p_parame

    -- Retrieve
    l_locidx :=
    l_latidx :=
    l_lngidx :=
    l_gisidx :=
    l_sosidx :=
    . . .

    . . .
    -- Loop thru returned values in the WSM result set
    WHILE APEX_EXEC.NEXT_ROW (wsm_context)
        LOOP
            IF APEX_EXEC.GET_VARCHAR2 (wsm_context, l_locidx) IS NULL THEN
                :P135_LATITUDE := NULL;
                :P135_LONGITUDE := NULL;
                :P135_QUALITYCODE := 'N/F!!!';
                :P135_SIDEOFSTREET := NULL;
            ELSE
                :P135_LATITUDE := APEX_EXEC.GET_NUMBER(wsm_context, l_latidx);
                :P135_LONGITUDE := APEX_EXEC.GET_NUMBER(wsm_context, l_lngidx);
                :P135_QUALITYCODE := APEX_EXEC.GET_VARCHAR2(wsm_context, l_gisidx);
                :P135_SIDEOFSTREET := APEX_EXEC.GET_VARCHAR2(wsm_context, l_sosidx);
            END IF;
        END LOOP;
    -- Close Web Source
    APEX_EXEC.CLOSE (wsm_context);

EXCEPTION
    WHEN OTHERS THEN
        -- Close Web Source
        APEX_EXEC.CLOSE (wsm_context);

END;
```

Loop thru all returned values, setting them as page variables

Complex Web Source Module Requests? APEX Packages to the Rescue!

```
. . .  
BEGIN  
-----  
-- Create a CLOB containing the necessary address elements  
-----  
APEX_JSON.INITIALIZE_CLOB_OUTPUT;  
APEX_JSON.OPEN_OBJECT;
```

... and calling WSMs with **APEX_WEB_SERVICE** when complex processing and formatting of **JSON or XML** is required

... but consider leveraging **APEX_JSON** to create, submit, receive, and interpret large volume batch requests instead ...

```
APEX_JSON.CLOSE_O  
  
sent_clob := APEX  
APEX_JSON.FREE_OU
```

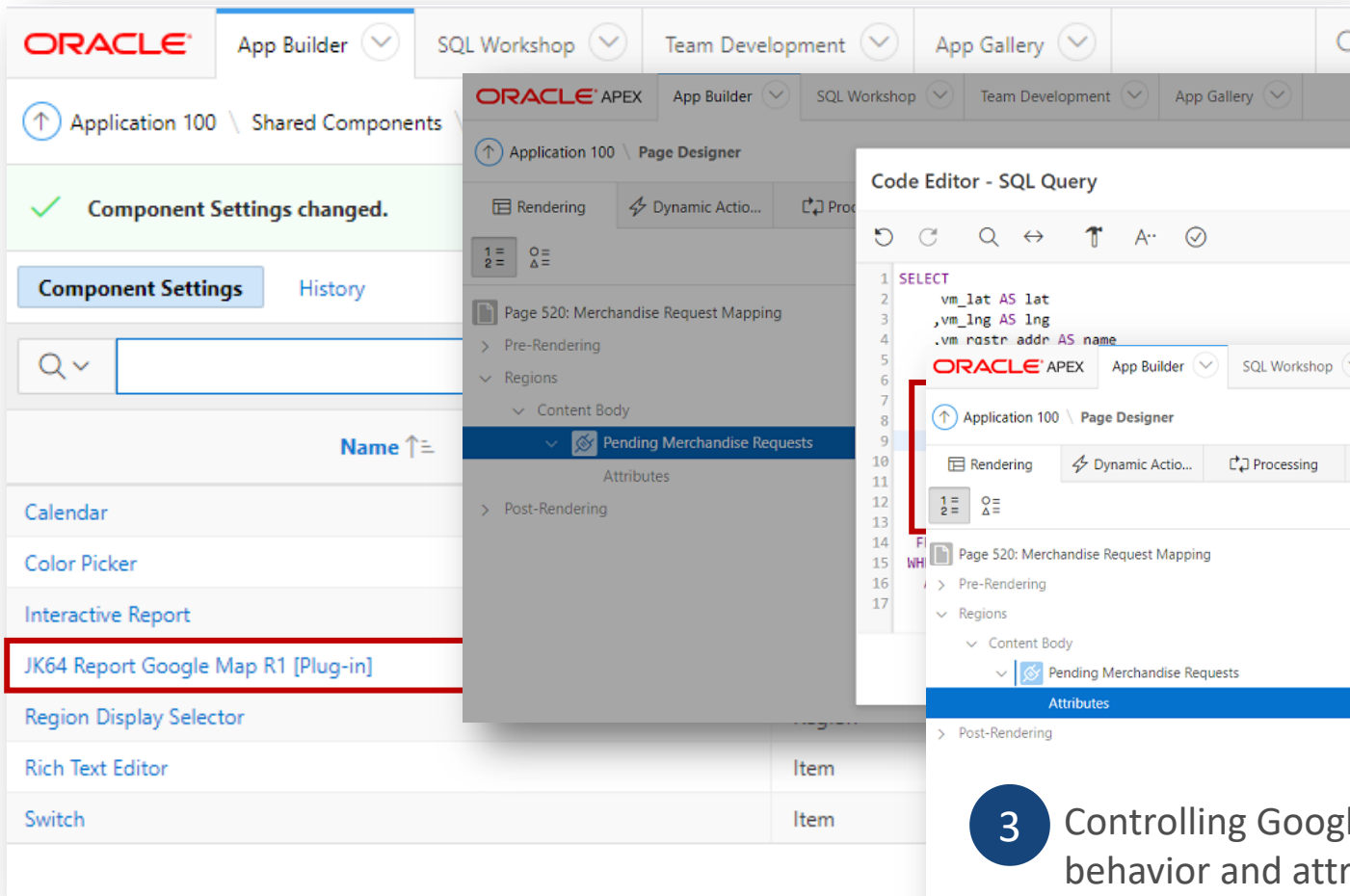
```
. . .  
APEX_WEB_SERVICE.G_REQUEST_HEADERS.DELETE ();  
APEX_WEB_SERVICE.G_REQUEST_HEADERS(1).name := 'Content-Type';  
APEX_WEB_SERVICE.G_REQUEST_HEADERS(1).value := 'application/json';  
  
recv_clob :=  
  APEX_WEB_SERVICE.MAKE_REST_REQUEST (  
    p_url => 'https://api.geocod.io/v1.6/geocode?api_key=ofe...^$#@%^&$#@...ee5'  
  ,p_http_method => 'POST'  
  ,p_body => sent_clob  
  );  
. . .
```

Mapping Our Progress ... Literally

- [APEX Google Map Plug-Ins](#)
- [APEX Oracle Spatial and Graph Map Plug-Ins](#)

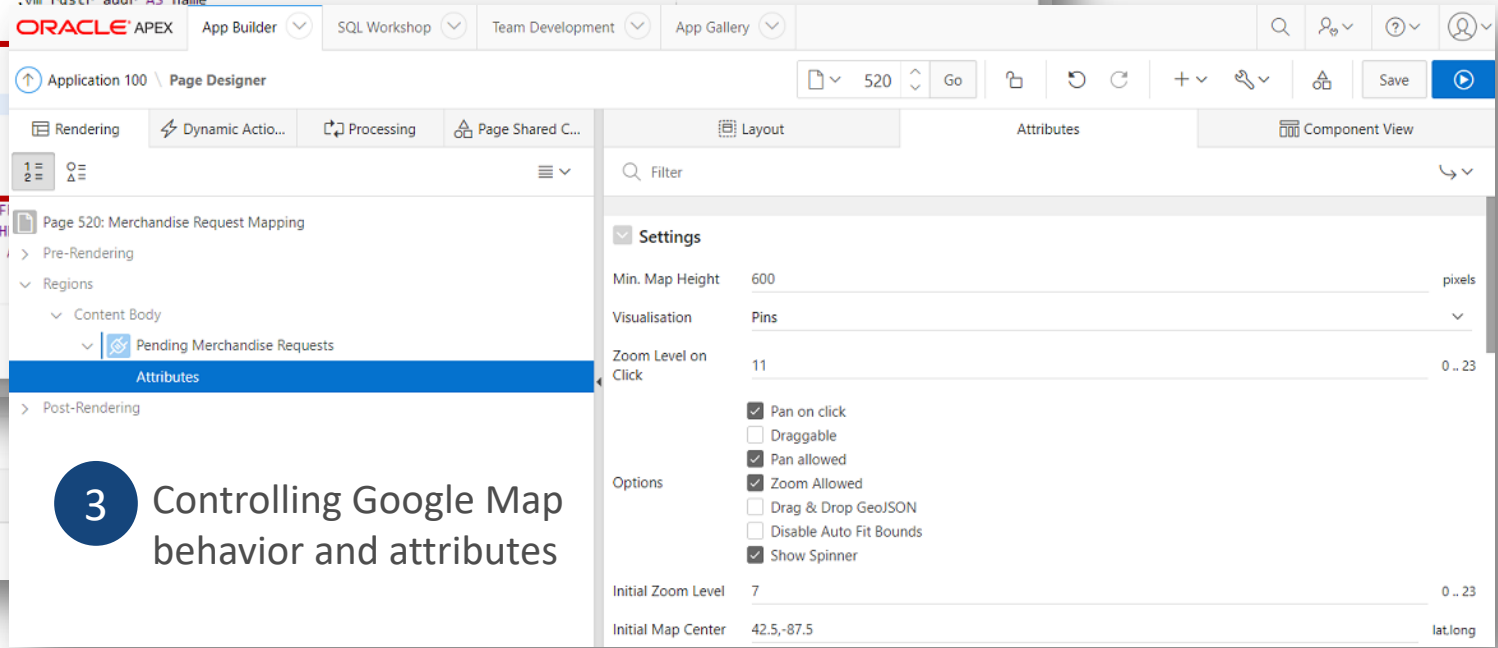
Leveraging Google Map Plug-In Features

1 Post-installation of Jeffery Kemp's Google Maps API Plug-in



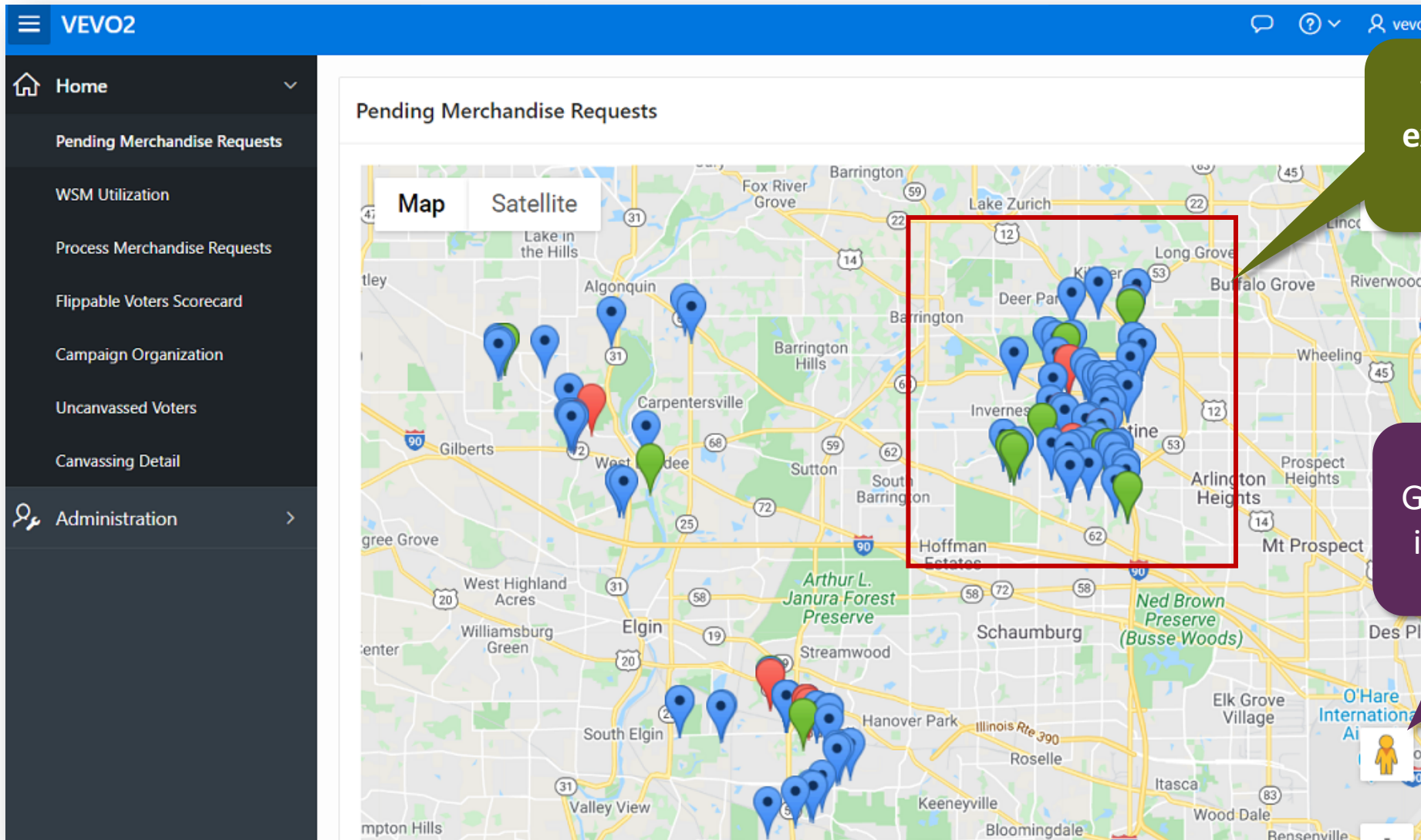
2 Build a query to add points on a Google Map

```
Code Editor - SQL Query
1 SELECT
2   vm_lat AS lat
3   ,vm_lng AS lng
4   ,vm_rastr_addr AS name
5
6
7
8
9
10
11
12
13
14
15
16
17
```



3 Controlling Google Map behavior and attributes

Voila! Google Maps for Merchandise and Sign Distribution



This is an **extremely simple example** of the power behind this plug-in!

Just about **any feature** of Google Maps can be exploited, including **distancing, routing, and directions**

Get Jeffrey Kemp's excellent Google Map Plug-ins: <https://jeffkemponoracle.com/2016/02/google-map-apex-plugins/>

A Last-Minute Request: Where Can I Drop Off My Vote-By-Mail Ballot?

A **heavily-gerrymandered** district, the Illinois Sixth Congressional District (IL-06) spans **five different counties: Cook, DuPage, Kane, Lake, and McHenry**

Vote-By-Mail (VBM) ballots must be dropped off within the same county in which you reside ... and some localities spanned **3** counties

Even **more** confusing, these VBM drop boxes:

- Are in different **locations** (some inside, some outdoors)
- Have different **availability schedules** (dates and times)
- And not all will be **open** on Election Day!



A Quick (But Imperfect) Solution, Via NodeJS, React, and GitLab

SEAN CASTEN
DEMOCRAT for CONGRESS

BALLOT DROP BOX FINDER

Find a secure ballot drop box in your community to safely vote for Sean Casten and other Democrats up and down the ballot.

ENTER YOUR CITY OR TOWN

Q e.g., "Downers Grove"

What is a secure ballot dropbox?

All across the Illinois 6th Congressional District, cities and towns are installing dropboxes where voters can return their completed ballots that they received in the mail. If you requested and received a mail-in ballot, returning your ballot via a dropbox in your community is a safe and secure way to make sure that your vote is counted. Please make sure to first complete your ballot (vote for Sean!) and then carefully follow all instructions provided with your ballot.

We'll be updating this directory with the location of the ballot drop box nearest to your location. If you are in a dropbox within the area, you cannot drop off your ballot at your local election office.

... and you'll get information about the drop box nearest to your locality in your county

SEAN CASTEN
DEMOCRAT for CONGRESS

Q Cook County - BARTLETT

HOW TO DROP OFF YOUR BALLOT IN COOK COUNTY - BARTLETT

MAKE SURE YOU'VE SELECTED THE RIGHT COUNTY!

NEAREST DROPBOX LOCATION

Rolling Meadows Courthouse
2121 Euclid Avenue
Rolling Meadows, IL 60008
[Google Maps Directions](#)

DROPBOX AVAILABILITY

Wednesday, October 7 - Tuesday, November 3
Mon-Fri 8:30 AM-7:00 PM and Sat-Sun 9:00 AM-5:00 PM

DROPBOX INSTRUCTIONS

The dropbox is located inside the Rolling Meadows Courthouse. Additional information is available at mail.voting@cookcountyil.gov

NOTE: ON ELECTION DAY, NOVEMBER 3RD, PLEASE FOLLOW THE INSTRUCTIONS OF THE ELECTION JUDGES AT YOUR POLLING PLACE TO INSURE THAT YOUR VOTE-BY-MAIL BALLOT IS HANDLED CORRECTLY, REGARDLESS OF WHETHER YOU HAVE ALREADY VOTED THAT BALLOT OR HAVE NOT YET FILLED IT OUT. THERE ARE ALSO SPECIFIC RULES THEY MUST FOLLOW IF YOU HAD REQUESTED A VOTE-BY-MAIL BALLOT, BUT NEVER RECEIVED IT, SO THAT YOU MAY STILL VOTE.

VOTE-BY-MAIL CONTACT INFORMATION FOR YOUR COUNTY

Should you encounter any difficulties while attempting to deliver your Vote-By-Mail ballot to a drop box facility, do not hesitate to contact your county election board representatives, either by e-mail (mail.voting@cookcountyil.gov), telephone ((312) 603-0946), or in person at the county offices (69 W. Washington St, Suite 500, Chicago, IL 60602).

Offering Voters a Choice: Finding the Closest VBM Drop Boxes

```
SELECT
  vbm_dbl_lat AS lat
, vbm_dbl_lng AS lng
, vbm_dbl_name AS name
, vbm_dbl_id AS id
, vbm_dbl_street_addr || ', ' || vbm_dbl_city || ', IL ' || vbm_dbl_zip_code AS info
, 'Dates: ' || TO_CHAR(vbm_dbl_opens_on, 'MON-DD') || ' - '
      || TO_CHAR(vbm_dbl_closes_on, 'MON-DD') || ' Hours: '
      || vbm_dbl_hours AS HoursOpen
, 'https://mt.googleapis.com/vt/icon/name=icons/spotlight/spotlight-waypoint-blue.png' AS icon
FROM vevo.vote_by_mail_dropbox_locations
WHERE vbm_dbl_county = (SELECT v_county_name
                        FROM vevo.voters_microcosm
                        WHERE v_id = &v_id)

AND vbm_dbl_opens_on <= TRUNC(SYSDATE)
AND vbm_dbl_closes_on >= TRUNC(SYSDATE)
AND SDO_NN(
  vbm_dbl_geopoint
, (SELECT v_geolocation FROM vevo.voters_microcosm WHERE v_id = &v_id)
, 'sdo_batch_size=5 distance=&dist unit=mile') = 'TRUE';
```

Capturing attributes for mapping display

Using SDO_GEOMETRY features to find the closest 5 drop boxes within a specific radius, in miles

Offering Voters a Choice: Mapping the Closest VBM Drop Boxes

The screenshot shows the VEVO2 interface with a sidebar on the left containing navigation options: Voters, Voter Demographics, Flippable Voters Scorecard, Locate Vote-By-Mail Drop Boxes, Merchandising, Campaigning, and Administration. The main content area is titled 'Voter Address Search' and includes a search bar and a 'Go' button. Below the search bar, there is a 'Lookup Results' section with a search filter and a 'Reset' button. A table displays the results, with the first row highlighted. To the right of the table is a map titled 'Closest Vote-By-Mail Drop Boxes' showing a map of the Chicago area with several blue location pins. A red box highlights a specific area on the map, and a yellow callout bubble points to it.

Location	County Name	VAN ID
1316 Blackhawk Ln, Bart...	DuPage	10165251
312 Woodview Rd, Lake...	Lake	19570501
315 E Prairie Ave, Lomb...	DuPage	4728751
2 S231 Valley Rd, Lomb...	DuPage	14658751
21319 N Elizabeth Rd, B...	Lake	5040001
310 Terrace Dr, Bartlett, ...	Cook	2051001
1318 Summersweet Ln, ...	Cook	4695001
315 Washington St, Barr...	Lake	2332751

1 rows selected Total 8

Closest Vote-By-Mail Drop Boxes

No Data Found

... produces a custom map of the closest drop boxes for each voter within the chosen radius

Don't Like Google Maps? Then Use Oracle's HTML5 APEX Mapping Features

The screenshot displays two views of the Oracle Geolocation Showcase application. The left view shows the 'Overview Map' with a table of customers and a map of the United States. The right view shows the 'Edit Address' form with a map of the Chicago area.

Overview Map View:

- Navigation menu: Home, Addresses, Areas of Interest, Overview Map, Within Distance Search, Nearest Neighbor, Area Of Interest Search, Heat Map, Administration.
- Section: Customers

Name	Created
Jim Czuprynski	09/2
Oracle UK	08/8
Oracle Deutschland B.V. & Co KG	08/8

- Section: Oracle eLocation Service
- Map: Overview map of the United States with a search icon and zoom controls.

Edit Address View:

- Section: Edit Address
- Buttons: Cancel, Delete, Show on Map, Geocode, Apply Changes
- Text: Enter the address details and click on the Geocode button. This will present a list of candidate addresses. Choose one by clicking on the address on the map. The map will focus on the coordinates of the selected address.
- Form fields:
 - Type of Address: Customer (selected), Supplier
 - Name: Jim Czuprynski
 - Street address: 318, Pebble Beach Ln
 - City: Bartlett
 - State or Province: IL
 - Country: USA
 - Postal Code: 60103
- Section: Oracle eLocation Service
- Map: Detailed map of the Chicago area with a red pin and search icon.

... and one click on the **Geocode** button captures and retains latitude & longitude values

Full details here: https://cloudmarketplace.oracle.com/marketplace/en_US/listing/75461594

Charting Campaign Progress

- Oracle Machine Learning Algorithms
- Visualizing Data In APEX With JET Charts

Application Express (APEX) and ML / Analytics: A Most Excellent Pairing!

APEX's extensive and flexible **application development capabilities** pair nicely with **ML algorithms and analytic reporting** techniques



- Accesses **same schema objects** that *Oracle Machine Learning (OML)* and *Oracle Analytic Cloud (OAC)* **already use**
- Powerful **reporting and graphic toolsets**
- **Seamless integration** with Autonomous DB (**ATP & ADW**)



Machine Learning and Analytics: Finding Order Amidst Chaos

ORACLE® Machine Learning on Oracle Database – What do you want to do?

OML Algorithms support parallel, distributed, in-database execution for performance and scalability, improved memory utilization, partitioned models, and automatic mining of text columns

Predict Categories → Classification

Target variable contains 2 or more distinct category values

Decision Tree	Generates human-interpretable rules, can be used for segmentation
Random Forest	High accuracy predictions, avoids overfitting
Naïve Bayes	Yields interpretable probabilities, assumes predictor independence
Support Vector Machine	High accuracy; linear or Gaussian kernel; IPM (non-linear, linear) and SGD (linear, wide data) solvers; sparsity optimizations
Logistic Regression	Narrow, wide, sparse data; QR, Cholesky, and SGD solvers; enables ridge, feature selection/generation, sparsity optimization
Neural Network	Well-suited to noisy and complex data, supports many hidden layers, binary and multiclass classification
Explicit Semantic Analysis	Text categorization with human-readable topic labels derived from corpus; semantic similarity estimates among documents

Predict Numeric Values → Regression

Target variable contains number (integer, real) values

Linear Model	Same results as R's lm(); global statistics, coefficient statistics, ...
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Group or Segment Cases → Clustering

All Input variables considered for grouping rows (cases) into clusters

K-Means	Produces k clusters in hierarchy; Euclidean and cosine distance, generates probabilities, rules, and statistics; sparsity optimizations
Orthogonal Partitioning	Discovers natural clusters in hierarchy up to maximum specified; density-based, generates probabilities, rules, and statistics
Expectation Maximization	Automated model search; protection against overfitting; numeric and multinomial distributions; high quality probability estimates; generates cluster hierarchy, rules, and other statistics

Derive New Values → Feature Extraction

All Input variables considered to generate reduced set of variables

Non-negative Matrix Factorization	Derives features based on non-negative linear combinations which makes features more interpretable
Singular Value Decomposition	Narrow data via Tall and Skinny solvers; wide data via stochastic solvers; eigensolvers (faster, sparsity) or SVD (more stable)
Principal Component Analysis	Uses SVD to obtain a set of uncorrelated variables that contain the maximum amount of variance from dataset
Explicit Semantic Analysis	Text categorization with human-readable topic labels derived from corpus; semantic similarity estimates among documents

See the full “cheat sheet” here: <https://www.oracle.com/a/tech/docs/oml4sql-algorithm-cheat-sheet.pdf>

Leveraging APEX for Machine Learning and Analytics

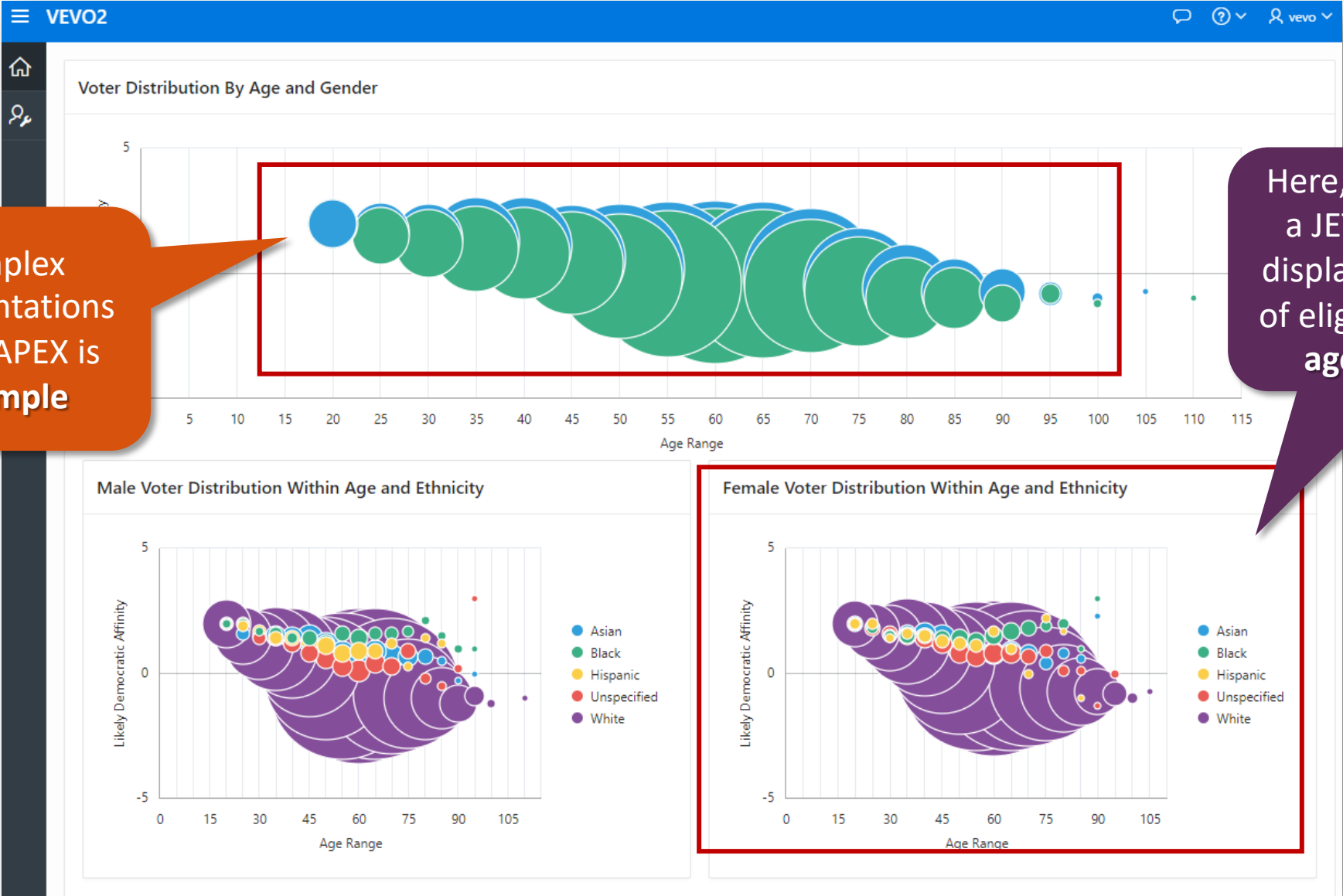
1 APEX makes it simple to visualize analytics results in graphic format ...

The screenshot displays the VEVO2 application interface. On the left is a navigation menu with categories like Voters, Merchandising, Campaigning, and Administration. The main content area shows a table titled 'Quantiles' with 12 columns. The first five rows of the table are highlighted with a red border.

Quantile	Probability Threshold	Gain Cumulative	Quantile Total Count	Quantile Target Count	%age of Cumulative	Cumulative Lift	Target Density Cumulative	Targets Cumulative	Non Targets Cumulative	Lift Quantile	Target Density
1	.6031	.0746	1,004	603	.0334	2,2350	.6010	603.35	400.65	2,2350	.6010
2	.6031	.1491	1,004	603	.0667	2,2350	.6010	1206.71	801.29	2,2350	.6010
3	.6031	.2237	1,004	603	.1001	2,2350	.6010	1810.06	1201.94	2,2350	.6010
4	.6031	.2982	1,004	603	.1334	2,2350	.6010	2413.42	1602.58	2,2350	.6010
5	.6031	.3728	1,004	603	.1668	2,2350	.6010	3016.77	2003.23	2,2350	.6010
6	.4485	.4366	1,004	516	.2001	2,1814	.5865	3533.25	2490.75	1,9132	.5144
7	.4485	.4917	1,004	446	.2335	2,1060	.5663	3979.71	3048.29	1,6539	.4447
8	.3358	.5371	1,004	367	.2669	2,0128	.5412	4346.92	3685.08	1,3602	.3657
9	.3358	.5788	1,004	337	.3002	1,9280	.5184	4684.22	4351.78	1,2495	.3360
10	.3358	.6204	1,003	337	.3335	1,8602	.5002	5021.19	5017.81	1,2495	.3360

2 ... as well as provide detailed formatted information on the accuracy of the data model itself

Applying APEX Data Visualization Via JET Charts



Building complex graphic representations of data within APEX is extremely simple

Here, we're leveraging a JET bubble plot to display the distribution of eligible voters within age and ethnicity

Useful Resources and Documentation

Articles on Leveraging APEX For ML, Mapping and Geolocation:

<https://www.odtug.com/p/bl/et/blogaid=966>

<https://www.odtug.com/p/bl/et/blogaid=981>

APEX_DATA_PARSER and APEX_JSON Implementation Examples:

https://blogs.oracle.com/apex/super-easy-csv-xlsx-json-or-xml-parsing-about-the-apex_data_parser-package

https://jsao.io/2015/07/relational-to-json-with-apex_json/

Two-Minute Tech Tips on Using GeoLocation, Spatial, and Graph Features:

Part 1: <https://www.youtube.com/watch?v=0MRnKsRL3-Q>

Part 2: <https://www.youtube.com/watch?v=7WAs1-bbWLM>

Part 3: <https://www.youtube.com/watch?v=bPL-AHrhI8s>

Jeffrey Kemp's Google Maps APEX Plug-ins:

<https://jeffkemponoracle.com/2016/02/google-map-apex-plugins/>

<https://jeffkemponoracle.com/tag/apex-plugins/>

<https://github.com/jeffreykemp/jk64-plugin-reportmap/wiki/SQL-Query-Examples>

OML "Cheat Sheet":

<https://www.oracle.com/a/tech/docs/oml4sql-algorithm-cheat-sheet-19c-v2.pdf>