GIS for Property Tax Professionals: Using ArcGIS Pro and the R-ArcGIS Bridge for Modeling Fair & Equitable Valuations

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Valuations, Valuation models, and GIS working together

• Visualize data variables spatially, graphically, and within tables at the same time.
• Provides the necessary functionality to run analysis
  - Look at relationships, patterns, and correlations.
  - Analyze model and ratio diagnostics.

  - Also provides a way for a professional who knows how to use GIS to build models in the valuation profession.

• This presentation will provide a demonstration of a workflow for using ArcGIS Pro to build a valuation model.
Steps for modeling property sales data in ArcGIS Pro

• Import sale data from CAMA using SQL or .csv file.
• Add XY data to display sales as points.
• Data exploration (Can do with the R bridge in R, or in ArcPro with python)
  - Analyze patterns and relationships, look at overlays etc.
  - Variable transformations if necessary using python or R.
  - Preliminary ratio study (Using a tool created from R bridge)
• Build an OLS or GWR model from spatial statistic tools
• Analyze model diagnostics and recalibrate if necessary.
• Analyze spatial distribution of coefficients and point estimates.
• Analyze ratio study diagnostics.
• Repeat as necessary!
Import Data from CAMA or other data source

Can connect directly to a data source and consume CAMA or sales data in SQL or Oracle.

Can write any SQL statement along with aliases and call PL/SQL functions.

Does not recognize commented lines.

Once table is built then can join on common attributes such as PARID in parcel polygon layer for CAMA attribution.

Sales can be built as points if XY coordinates are part of the query.
Exploratory Data Analysis
Exploratory Data Analysis
Exploratory Data Analysis
R – ArcGIS bridge script tool

```
install.packages("arcpygisbinding")
library(arcpygisbinding)
arc.check_product()
```

![Tool Properties: Sales Ratio Study](image1)

![Tool Properties: Sales Ratio Study](image2)
R – ArcGIS Bridge and the sales ratio study script

```r
# ----------------------------------------
# # Calculate sales ratio statistics
# # ----------------------------------------
# size <- length(dfRatios)
# med_rat <- median(dfRatios)
# mean_rat <- sum(dfRatios) / size
# wmean_rat <- sum(dfRatios) / sum(dfRatios)
# find COD
# cod_rat <- c(dfRatios) > median(dfRatios)
# names(cod_rat) <- \texttt{\textasciitilde}
# find prd
# prd <- mean_rat / wmean_rat
# find pb
# value <- (dfRatios + med_rat - dfRatios)/2
# log <- log(dfRatios) / log(2)
# per_diff <- (dfRatios + med_rat)/med_rat
# reg <- 1 + per_diff
# summary(reg)
# prob_rat <- reg[coefficient][2]
# prob_as.numeric(prob_rat)
# names(prob_rat) <- NULL
# # ----------------------------------------
# # Calculate confidence interval
# # ----------------------------------------
# prob_confidence_interval <- c(prob - qt(p=0.91, df=size)*summary(reg)[coefficient][2],
# prob + qt(p=0.91, df=size)*summary(reg)[coefficient][2])
# # Calculate results in separate dataframe
# resultsRATIOS <- data.frame
# # ----------------------------------------
# # Rename variables from memory
# # ----------------------------------------
# # Sales ratio statistics results
# print(resultsRATIOS)
# # ----------------------------------------
```
Geographically Weighted Regression (GWR)

Using ArcGIS Pro

Click to watch video
Model results and diagnostics
Analyzing the results
Why perform this analysis in GIS?

• Most local governments have ESRI licenses.
• R is free!
• Puts additional tools in the hands of assessors to view their sales data and analyze statistical relationships without needing a statistician on staff.
• Allows assessors to visualize what’s happening and where!

Go Further

• Use Cluster and grouping tools to segment out areas and understand what forces are shaping the market.
• Use interpolation to build statistical surfaces.
• Extrude into 3D
Thank You!!

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