What is positional accuracy assessment?

The workflow

Positional accuracy is the quantifiable value that represents the positional difference between two geospatial layers or between a geospatial layer and reality. An example of this is the comparison of the location of roads in a feature class versus their location in a TIFF image. If the feature class and the TIFF are using the **same projection**, you can assess the positional difference between the feature class and the TIFF. The Positional Accuracy Assessment tool (PAAT) allows you to compare two items to assess a data layer's accuracy in relation to a reference layer of known or unknown accuracy.

To assess positional accuracy, two layers are required: the layer whose accuracy you want to evaluate and another layer that can be used as a point of reference. The uncertainty is defined as the circular error (CE) for two-dimensional features and linear error (LE) for three-dimensional features. The confidence level for the feature class or raster being evaluated can be at the 90, 95, or 99 percent level when you use the PAAT.

You can use z-enabled data for one or both of the layers in a PAAT session. The only time the PAAT will use the 3D component of z-enabled data is when you are comparing a DEM or TIN to a 3D point feature class or shapefile.

Scenarios

There are four main scenarios when using the Positional Accuracy Assessment Tool (PAAT) tool to assess positional accuracy: using two feature classes, a feature class and a raster, two rasters, and a z-enabled point feature class and digital elevation model (DEM) raster or triangulated irregular network (TIN). The different combinations of layers for evaluation and reference cause the PAAT session to be variable based on what you are using as an evaluation layer versus a reference layer. For example, using two feature classes creates a grid on the reference layer, but if you are comparing a z-enabled point feature class to a DEM, the grid does not appear.

The scenarios and their respective behaviours are as follows:

- Feature class and feature class—Feature classes are used as both the evaluation and reference layers. When one of the feature classes contains points, the point that is digitized in the evaluation layer is automatically associated with a feature in the feature class. You can also configure the session so the point in the evaluation layer automatically snaps to a vertex on the closest feature. This ensures that the points digitized relate to actual features in your feature class.
- Feature class and raster—A feature class is used as one of the layers, and a raster is used as the other. You can use the raster layer as either the reference or evaluation layer in this scenario. When a feature class is used as the reference layer, the features act as control points for the raster you are evaluating. This means you can only review the residual values and the levels of error for the raster layer.
- Raster and raster—Raster's are used as both the evaluation and reference layers. One raster is the reference, and the other is evaluated. When rasters are used for both layers, there is

no snapping, since there are no features to snap to. This means you need to visually pick matching points on both layers.

- DEM raster or TIN and a z-enabled point feature class—A z-enabled feature class is used as the evaluation layer, and a raster is used as the reference layer. Raster's can only use z-enabled point feature classes in a PAAT session. The points in the feature class act as control points for the raster because the PAAT evaluates each point in relation to the raster.

Fields associated with PAAT statistics

- Residuals
- Accuracy
- Settings

Various parameters are used to calculate the positional accuracy of a point compared to the imagery or other data being used as a point of reference. You can adjust the calculations by changing parameters or by making points inactive. You can change the confidence level and calculation methods used to obtain the statistics. When either of these parameters is changed, the statistics for the set of points can be automatically recalculated, or the analyst can choose when to recalculate. This also happens when you uncheck a point in the table to make it inactive.

Residuals

Fields associated with the residuals

Field Name	Description
3 Sigma	A value that represents the mean residual plus three times the standard deviation. Any residual value that is greater than the three-sigma threshold is considered to lie outside the valid values.
Mean	The average of all the residual values for the points digitized.
Standard Deviation	A measurement that describes the way points have been dispersed. The more widely the points have been digitized on the map, the larger this value will be.
Active vs. Total Points	The number of points that are active versus the total number of points digitized during the PAAT session.

Accuracy

Fields associated with the accuracy

Field Name	Description
Absolute CE	The absolute circular error (CE), or horizontal accuracy, expressed in the reporting units, based on the x- and y-values.
Relative CE	The National Geospatial-Intelligence Agency (NGA) definition of relative circular error, expressed in the reporting units. This is a measure of the consistency of horizontal error direction and magnitude of the points picked in the layer being evaluated.
RMSE	The root mean square error (RMSE). This is a statistical measurement of the variance between the residual values.
Absolute LE	The absolute linear error (LE), or vertical accuracy, of the evaluation points to the reference points based on the z-values.
Relative LE	The NGA definition of relative linear error (LE), expressed in the reporting units. This is a measure of the consistency of vertical error direction and magnitude of the points picked in the layer being evaluated.

Settings

Fields associated with the settings

Field Name	Description
Reporting Units	The unit of measurement associated with the statistics. This applies to the Absolute CE, Relative CE, Absolute LE, Relative LE, RMSE, Mean, Standard Deviation, and 3 Sigma values.
Confidence Level	The statistical confidence level for the accuracy assessment. The value for this field can be 90, 95, or 99. The statistics are recalculated appropriately when this value is changed.
Calculation Method	The calculation method used for the statistics. You can use the NGA standard or United States Geological Survey (USGS) standard calculation method.

NOTE – PAAT tool can be found as an extension to ArcMap – still available on appsanywhere. After opening ArcMap – click Customise – Extensions and make sure Reviewer is selected. Then in the Toolbars – select Positional Accuracy Assessment

OR

There is now an online app under Imagery workflows - https://doc.arcgis.com/en/imagery/workflows/resources/accuracy-assessment-of-orthomosaics.htm