For the fiscal year 2022 GeoTASC on WUI wildfires GTAC created a deep learning model that classifies building objects with damage status using high resolution post fire imagery. The deep learning model was created with [ESRI Deep Learning Tools](https://pro.arcgis.com/en/pro-app/3.0/help/analysis/image-analyst/deep-learning-in-arcgis-pro.htm#:~:text=Deep%20learning%20tools%20in%20ArcGIS,objects%2C%20or%20classify%20image%20pixels.) available in the Image Analyst Extension with methods very similar to those outlined by [Yu, 2021](https://learn.arcgis.com/en/projects/automate-fire-damage-assessment-with-deep-learning/). The model we selected as the back bone to train was the CNN ResNet-18 because of its prior success with classifying postfire building damage in [Galanis et al., 2021](https://www.sciencedirect.com/science/article/pii/S221242092100501X). The model was trained on data from the Chimney Tops 2, Tubbs and Waldo fires and was tested on the Carr fire where it performed with a ~92% accuracy.

To continue to test the model, ESRI ArcGIS Pro v3.0 or greater with the Image Analyst Extension enabled is required. Additionally, a copy of the final model itself, high resolution postfire imagery and building objects. The model is stored as a “.dlpk” file and can be found in the “Final\_ResNet18\_CNN\_Model.zip” file delivered upon the GeoTASC project closeout. The “ResNet18v2\_E10B32V30.dlpk” should be selected as the “In\_Model\_Definition” with the [Classify Objects with Deep Learning](https://pro.arcgis.com/en/pro-app/latest/tool-reference/image-analyst/classify-objects-using-deep-learning.htm) tool. Of note, for the tool to work correctly, the “.dlpk” file must be stored locally.

The postfire imagery used as the “In\_Raster” for the Classify Objects with Deep Learning tool *must* be just one file (we used “.tif”), *must* be RGB bands only and *should* be 0.5m spatial resolution or less. This model was trained on 0.4m WV3 imagery which was collected with the USDA Digital Globe License on G-EGD portal. G-EGD is a source that could likely be used for future acquisitions of postfire imagery. Note that model performance would *likely* decrease if the model was applied on imagery with coarser spatial resolution than 0.4m. It is unknown how model performance would be affected by using imagery with finer spatial resolution than 0.4m or by using imagery other than WV3 like Planet. These are things that could be tested with future model runs.

The building objects used as “In\_Features” for the Classify Objects with Deep Learning tool can come from any source like a federal, county or private data base like Microsoft. For the GeoTASC project we created the building objects for model training from lidar and then acquired Microsoft building dataset to test the model. The source of building objects does not matter as they simply serve as a spatial reference for the model to look at the imagery and make a prediction. Of note, the model was trained on image chips that included a building and the 5 meters around that building. So, the building objects *should* be buffered by 5 meters prior to input. The 5m buffer was used to account for small misalignments between imagery and building objects. It is unknown how the model would perform if the building objects were buffered by a greater distance to account for larger discrepancies between imagery and building objects. The buffer distance around the buildings used as input for the model could be tested with future model runs.

In general, best model performance would likely come from a 0.4m WV3 imagery where the building objects have been buffered by 5m and the buildings in the imagery being classified are *clearly* not destroyed indicated by a standing building or *clearly* destroyed through the presence of building rubble. The model output will be a feature class named as the input for “Out\_Feature\_Class” with a numeric “ClassLabel” field where 0 is not destroyed and 1 is destroyed. Spatial DINS information is often available on AGOL or county websites for California fires which act as a great source for facilitating semi-automated model validation. For additional information please reference the 2022 WUI GeoTASC project report or contact GTAC analyst Zackary Werner (Zakary.werner@usda.gov) or the GeoTASC project manager at GTAC Eric Rounds (eric.rounds@usda.gov).