# CanoPie — Quick Start & User Guide (v1)

**Tip:** CanoPie is tab-based. You can open many projects at once, switch between them and even copy polygons across tabs.

## 1. Install ExifTool and point CanoPie to it

* **Install ExifTool.** Download and install [ExifTool](https://exiftool.org/) (by Phil Harvey).
* **Set the ExifTool path in CanoPie.** In CanoPie, open the **File** menu and choose **Set ExifTool Path**. The application will search common locations and then let you browse to the executable (for example, exiftool.exe). Once selected, the same path is applied to all open tabs.

## 2. Bring data in

### A. Open RGB / stacks

* From the **File** menu select **Open RGB/stack** and choose the folder containing your RGB images or stacked TIFF files.
* After loading the images, **Save Project** (or use **Quick Save**) so that root mappings and per-image coordinates persist in project.json. CanoPie also supports **Load Project** from a folder that contains project.json to reload paths, polygons and settings.
* You can display multiple viewers per root when first opening images. More viewers require more resources; adjust the number according to your hardware.

### B. Open multispectral / multi‑sensor

* Select **File → Open multispectral/multiple Folder** to load several images that share the same root (e.g., IMG\_0001\_1, IMG\_0001\_2, etc.). CanoPie extracts the root name and groups images accordingly so that images from different sensors or filters of the same scene appear together.
* **Dual-folder workflows:** when two folders represent paired datasets (such as RGB and thermal), assign both to the same root using the **Set root** tool in the module menu. The paired datasets will be synchronized so that the viewers move together. If you skip the second folder, the loader ignores it.
* Always remember to save after opening; reading images and extracting basic EXIF data may take some time.
* You can also drag images from your computer into an empty project. CanoPie will automatically load them in batches of 10 images to provide fast viewing.

### C. Load multiple projects at once

* Select **File → Load Multiple Projects** to detect subfolders containing project.json files and open each in its own tab. This feature is useful for multi‑site or multi‑date studies.

## 3. How images are displayed (stretch & speed notes)

* Previews are normalized per channel to a percentile window for a crisp, consistent appearance. This provides stable contrast regardless of outliers.
* The default normalization window is **0.5 %–99.5 %** for each channel. A histogram stretching tool will be added to the image viewer editor in the future so that users can adjust the stretch manually.

## 4. Draw & manage polygons (and points)

### Drawing

* Hold **Shift** and click to start drawing polygons in the active viewer. To close the polygon, double‑click quickly or press the right mouse button.
* **Synchronization is on by default:** the same polygon coordinates are replicated across viewers of the same root, ensuring that annotations align between sensors and resolutions.

### Copy and reuse quickly

* In the **Copy Polygons** menu you can: copy polygons to the next root, previous root or all roots; copy polygons to the next tab for cross‑tab reuse in multi‑project workflows.
* When the sources differ in resolution (for example, a FLIR Duo Pro R JPG versus a TIFF), CanoPie reprojects and scales polygons to the target viewer’s resolution so that drawing in one sensor is correctly transferred to another. This process may take some time when using the **copy to all polygons** tool. If you have not changed or have different image resolutions, select the **fast polygon copy** option.

### Polygon Manager

* The **Polygon Manager** lists all polygons and points and supports multi‑selection, deletion, moving, copying and zooming.
* Clear polygons for the current root (**Clean root Polys**) or a single viewer (**clear in viewer**) using the manager’s controls. You can also perform bulk deletion.
* **Import polygons:** supported when names and metadata match the target image or root. If not, CanoPie still imports them into the current viewer so you can manually reassign or move them.

### Import polygons from another project (geo‑match)

* Use **Import from Project (nearest)** when you have geotagged imagery across projects. CanoPie matches polygons to the closest images by geographic distance to speed up reassignment.

## 5. Non‑destructive editing (.ax pipeline)

* Open **Edit** on any image viewer to crop, scale, rotate or run band multiplications (index math).
* **Always rotate first** so that downstream operations align correctly.
* CanoPie does not modify the original images. Edits are stored in a sidecar .ax file and applied in a deterministic pipeline, crop, then resize, then expressions,during extraction.
* **Supported:** TIFF, RGB formats and multi‑band stacks.  
  **Not supported:** GeoTIFFs (georeferencing is ignored). Images are loaded anyway.

## 6. Pixel values & inspection

You can read pixel values in two ways:

1. **Inspect mode (I):** toggles a cursor that reports pixel values and metadata from the active image or stack. This is useful for quality checks and quick label sampling for machine learning models.
2. **Per‑polygon or per‑point extraction:** available from the Polygon Manager’s context menu. This method is precise but can be slower for large regions; prefer points if you are rapidly curating training sets.

## 7. CSV exports (polygons, stats, band‑math, RF, EXIF)

### One‑shot per project or across tabs

* Use **File → Extract All CSV from Current Project** to export data from the active tab.
* Use **File → Extract All CSV from All Projects** to export data from every open tab.
* **EXIF‑only:** There is also an option **Extract EXIF → CSV** when you just need metadata for all images. This uses the same delimiter/CSV settings as the polygon export.

### Analysis Options dialog (what gets computed)

Open the **Analysis Options** dialog before exporting to configure:

* **Statistics:** Mean, Median, Standard Deviation and Quantiles (comma‑separated list; accepts values between 0–1 or 0–100).
* **Polygon pre‑processing:** Shrink or swell polygons (factor and direction).
* **Random‑Forest classification:** a per‑pixel to polygon percentage breakdown. You can load random forest models via the main tab, so you do not need to load them every time you export a CSV. The random forest model calculates the percentage of each specified class within each polygon.
* **Export modified polygons JSON** (for audit or reuse).
* **Include EXIF metadata in the CSV:** EXIF data will only be included if you have set the ExifTool path correctly.
* **Band‑math indices:** Write simple expressions using b1…bN (where b1 = Red, b2 = Green, b3 = Blue and additional bands continue b4+). JSON or name=expression lines are accepted. Defaults include indices such as GCC, EXG, RCC, BCC and WDX. These calculations derive indices within each drawn polygon and can handle any number of bands, stacks and RGB.

### How band‑math works in Export csv

During export, CanoPie compiles the expressions once and evaluates them safely on arrays. Results are treated as virtual bands for which you can compute scene or global statistics.

### Random‑Forest (RF) integration

* **Load a model:** from the main toolbar choose **Load Random Forest Model** and select a .pkl file. The application uses a shared model for all tabs.
* During export, CanoPie constructs the feature stack based on the feature\_names saved in your model (for example, red\_channel, green\_channel, blue\_channel).
* CanoPie then performs per‑pixel predictions within each polygon and reports class percentages (counts divided by total) in the CSV.
* This means a model trained on three RGB bands or on 4–15‑band stacks works. The CSV shows the percentage for each class name in the model’s classes.
* For points, the prediction collapses to a single pixel, so one class will usually show nearly 100 %.

### EXIF in the CSV

* When **Include EXIF** is enabled, CanoPie calls ExifTool using your configured path and appends EXIF tags as extra columns for each row (point/polygon/channel). It logs how EXIF was obtained and which tags were requested (see **Set ExifTool Path** above).
* If you only need metadata, use **EXIF → CSV** to scan all images and write a flat EXIF table. This follows the same delimiter rules as polygon CSV exports.

### Performance tips for CSV extraction

* **Band‑math, EXIF extraction and Random‑Forest classification** are the main performance bottlenecks. If you are just exploring, try an EXIF‑only export first and run heavy analyses later.
* Lower the export resolution in **Edit** (resize) to speed up processing for large images; the .ax sidecar maintains determinism.

## 8. Image Editor recap (what’s stored in .ax)

* Viewers are fast and keep pixels crisp; zooms and fit‑to‑window are responsive.
* The .ax file records cropping, resizing and optional band expressions in that order so that CSV extraction is reproducible and viewer‑independent. To crop, draw on the image displayed in the image editor viewer.

## 9. Thumbnails

* Select **File → Save All Thumbnails** to save preview tiles for every polygon in the current project. This is useful for QA and machine learning dataset inspection.

## 10. Supported image formats

* CanoPie supports **TIFF, RGB images and multi‑band stacks**.

## 11. Keyboard shortcuts

### Main window (global)

| Shortcut | Action |
| --- | --- |
| **Ctrl + N** | New tab |
| **Ctrl + W** | Close current tab |
| **Ctrl + O** | Open multispectral/multiple folder |
| **Ctrl + R** | Open RGB/stack |
| **Ctrl + L** | Load project |
| **Ctrl + M** | Load multiple projects |
| **Ctrl + Shift + S** | Save project |
| **Ctrl + Shift + F** | Change folders path |
| **Ctrl + Alt + S** | Extract all CSV (current project) |
| **Ctrl + Shift + A** | Extract all CSV (all projects) |
| **Ctrl + T** | Save all thumbnails |
| **Ctrl + Q** | Exit |

### Tab navigation (global)

| Shortcut | Action |
| --- | --- |
| **Alt + 1** | Previous tab |
| **Alt + 2** | Next tab |
| **Alt + 3** | Copy polygons to next tab (cross‑tab) |

### Project tab (local)

| Shortcut | Action |
| --- | --- |
| **Ctrl + O** | Open folder (tab‑local) |
| **Ctrl + S** | Save current CSV |
| **→ / ←** | Next/previous group (root) |
| **A / D** | Previous/next group (single key) |
| **O** | Toggle sync on/off |
| **Ctrl + X** | Clean root polys |
| **P** | Polygon manager |
| **Ctrl + Shift + S** | Save project (tab) |
| **Ctrl + L** | Load project (tab) |
| **Ctrl + Q** | Quick save project |
| **Alt + Right / Alt + Left** | Copy polys next/previous |
| **Ctrl + Shift + A** | Copy polys to all roots |
| **Alt + 3** | Copy polygons to next tab (tab‑local) |
| **Ctrl + M** | Show map (tab) |
| **I** | Inspect (toggle) |
| **Ctrl + Shift + M** | Machine learning manager |
| **E** | Refresh viewer |
| **Z** | Zoom all (fit) — application‑wide |

### Image editor (Edit dialog)

| Shortcut | Action |
| --- | --- |
| **Ctrl +[** | Rotate 90° counter‑clockwise |
| **Ctrl +]** | Rotate 90° clockwise |

**Heads‑up on overlapping shortcuts:**

* **Ctrl + M** is both “Load multiple projects” (global) and “Show map” (tab). The action depends on which window is focused: if a project tab is focused, it opens the map.
* **Ctrl + Shift + A** is both “Extract CSV (all projects)” (global) and “Copy polys to all roots” (tab). Focus determines which command is executed. Consider remapping if you prefer zero ambiguity.

## 12. Recommended workflow (TL;DR)

1. Install ExifTool and set the ExifTool path.
2. Open RGB/stack or open multispectral folder(s).
3. Save the project to persist roots and coordinates.
4. Use **Edit** to rotate first, then crop/resize (non‑destructive using .ax).
5. Draw polygons (hold **Shift**), keep Sync ON and use copy shortcuts to propagate them.
6. **Inspect** (press **I**) to quality‑check pixels; optionally run **EXIF → CSV** to collect metadata.
7. Load your random‑forest model (.pkl) if you want per‑class percentage outputs.
8. Extract all CSVs (current or all projects) with your chosen statistics, band‑math expressions, EXIF and random‑forest.
9. Save thumbnails for quick machine learning quality assessment.
10. Quick Save or Save Project before closing.