

## PyMovie version history

### version 1.3.5

- Added printing of the 'confusion matrix' (correlation scores of each model digit against all the others) when 'show model digits' is invoked.
- Fixed the spurious exception that was occurring when FITS folder was in use (caused by trying to do timestamp extraction as though a VTI were in use)

### version 1.3.4

- Fixed BoxSprite 'start-from-scratch' specifying None instead of boxsprite as timestamp formatter.

### version 1.3.3

- Fixed BoxSprite 'start-from-scratch' specifying iota instead of boxsprite as timestamp formatter.

### version 1.3.2

- Saving and reusing custom ocr profiles (i.e., ocr boxes and model digits from an AVI-WCS folder), is now functional. The custom profile list is placed in the users home directory and named `pymovie-ocr-profiles-<username>.p` For me, <username> is bob, so the file is named `pymovie-ocr-profiles-bob.p`  
It is possible to share your complete list of custom ocr profiles with another user. For instance, I have another custom profile list in my home directory named `pymovie-ocr-profiles-tony.p`  
That ocr profile list came from Tony George (and implements profiles that allow the reading of 4 line BoxSprite timestamps). All lists of the form `pymovie-ocr-profiles*.p` in a users home directory are available as custom ocr profiles.
- Sharing a complete list of profiles is probably not the way to go most times as there would be too many entries from someone like Tony (who has to deal with many recording chains, each requiring slightly different ocr profiles). Instead, you could share the four files (in an AVI-WCS folder) that comprise the ocr profile:  
`custom-boxes-upper.p`  
`custom-boxes-lower.p`  
`custom-digits.p`  
`formatter.txt`  
Sharing just those files is all that is required. Put them in your AVI-WCS folder and then click on the Save OCR profile button to save that profile with a name of your choosing in your personal list of custom ocr profiles.

### version 1.3.1

- Added to ocr box right-click menu: retrain model digits, enable/disable upper/lower boxes.
- Added automatic switch to frame view if field view was selected and then Start analysis was clicked. It is possible to Pause analysis and then switch to field view without loss of data.
- Removed threshold spinner as that mechanism is no longer used for OCR --- switched to custom model digits per AVI-WCS folder instead.
- Fixed problem that kept ocr box changes and model digits from being properly preserved and restored from an AVI-WCS folder.
- Laid some framework in place for saving and reusing custom profiles (i.e., ocr boxes and model digits from an AVI-WCS folder)

### version 1.3.0

- We now require that an avi --- for which timestamp OCR extraction is wanted --- be placed in an AVI-WCS folder. This allows completely custom ocr box placement and modelDigit training. This need only be done once. When that folder is reopened, it will snap to frame 1 with ocr boxes placed and the correct vti selected. The value of training for each file is that the highest OCR accuracy will always be obtained.

### version 1.2.9

- Made the cascading of lightcurve plots optional (and sticky)
- Made the ocr box context menu sensitive to which digits are missing from the modelDigit list.

- When a Kiwi or BoxSprite avi is in a folder, we put modelDigits and ocr box table in that directory so that OCR can be customized on a file basis.
- When an IOTA avi is in a folder, we put the ocr box table in that directory, but keep using the standard model digits from the home directory. So the user can customize ocr box placement on a file by file basis for IOTA VTI timestamped avis without affecting the preset (optimized) model digits.

#### version 1.2.8

- Timestamp OCR for IOTA VTI models 2 and 3 are functional and useable.
- Timestamp OCR for BoxSprite is useable, but a little tedious as it requires 're-training' at every run in order to deal with the lack of well-formed and reproducible characters.
- Timestamp OCR for Kiwi is not useable (except to demonstrate and play with the challenges of the Kiwi timestamp quirks).

#### version 1.2.5

- Adds both lefthand and righthand ocr selection boxes to the IOTA VTI to deal with the ambiguity that arises when some cameras emit the odd field first in time while others emit the even field first in time.

#### version 1.2.4

- Removed the main gui buttons that jogged the ocr selection box constellation up/down/left/right. That function has been taken over by a new right-click context menu item that allows all ocr boxes to become joggable by use of arrow keys.

#### version 1.2.3

- Fixed the omission: when AVI-WCS folder opened, the navigation buttons were not being set to match the detected fps; that is fixed.
- Timestamp OCR is now functional for the IOTA VTI. Model 3 is directly supported. Model 2 (which interchanges the position of the early millisecond characters (VTI3: early on left; VTI2: early on right) can be decoded as well if one takes the time to reposition the ocr selection boxes. Such a change is 'sticky'. This is useful when there is a single tool chain (camera/VTI/frame-grabber) because, once set for your equipment setup, it will be ready to go next time.
- Recommended work flow: open avi, select VTI, click the appropriate radio button that tells PyMovie which field (top or bottom) is first in time, adjust ocr selection boxes (if needed), leave field display mode and place measurement apertures as usual.

#### version 1.1.8

- Changed the titling on the frame navigation buttons to use time units for ntsc/pal recordings --- fits still uses frame units as there is no set correlation between frames and time for fits recordings.
- Lightcurve plots now cascade (don't overlap) from the upper left corner of your screen down and to the right (rather than be plotted on top of each other in the center of your screen).

#### version 1.1.7

- Made the jump forward and backward frame navigation buttons adapt to ntsc frame rate (uses 30 and 300 frame jumps) and pal frame rate (uses 25 and 250 frame jumps). For fits files the jumps remain at 25 and 200

#### version 1.1.6

- Added a 'Write' button to the Edit Aperture widget so that it is not necessary to close that widget to make changes take effect. Closing the widget still makes changes take effect --- that remains unchanged.
- It is now possible to change the x,y value of an aperture from the Edit Aperture widget. This will make it easy to stack apertures by a simple copy and paste operation of the (x,y) data.

#### version 1.1.5

- Added spinner to change default mask radius of any 'green' aperture present.
- Added linkage from the aperture edit table to the default mask radius spinner and threshold spinner so that when the color of an aperture is set to 'green' (even if it already was 'green'), the def mask radius

and thresh are copied into the spinners on the main gui..

version 1.1.4

- Fixed the aperture position limit issue that occurs when the aperture size is changed AFTER the image has been loaded.

version 1.1.3

- Removed some no longer needed diagnostic messages being printed in the textOut panel.

version 1.1.2

- Implements output of csv aperture data in the order specified by the user rather than the default order based on the order of adding apertures to the image. For now, PyOTE accepts only up to the first four light curves, so when multiple apertures are in use, this re-ordering will make sure that you will be able to use PyOTE on the relevant lightcurves. It is possible (in the future) that PyOTE will be modified so that more than 4 lightcurves can be processed at the same time. Until then, be judicious in selecting/ordering the apertures.

version 1.1.1

- Removed the log scaling checkbox. Log scaling rarely used and the image control is an adequate and flexible tool for image clipping and scaling to better see stars in an image
- Added an Edit Aperture tool that pops up a list of all aperture with their properties and provides a central place to modify same. This will make it easier to deal with stacked (overlapping) apertures.
- Added a default mask radius setting for each aperture rather than the one-size-fits-all of prior versions to better support the use of multiple sampling aperture/masks.
- Removed the spinner previously used for setting a global default mask.
- Changed status bar display when mouse is hovered over an aperture to simply show a list of any apertures that are under the cursor (again in support of stacked/overlapping apertures). Previously all the special properties of the topmost aperture were output to the status bar. That was not helpful when apertures were stacked on top of each other. Now the Edit Aperture list lets one see all the properties of all the apertures, so it's more important to be able to locate apertures via mouse hover, hence this change.

version 1.1.0

- Added a check on the validity of RA Dec strings on a program path that was missed in 1.0.9.

version 1.0.9

- Tests the validity of RA Dec strings at the point of entry --- shows errors in textOut panel.
- Returns the aperture jogging capability that was inadvertently suppressed in 1.0.8 by the new right-click-for-help system

version 1.0.8

- Made splitter settings 'sticky' so that user choices as to how much gui real estate to give to buttons versus image and textOut versus Thumbnails is preserved between sessions.
- Fixed the tooltip/help info re UCAC4 format to say XXX-XXXXXX (had been XXX-XXXX)

version 1.0.6

- Polished the right-click help system. Now the help dialog box can be sized and placed by the user and it will be reused (as it was in the original hover-for-help system) for subsequent right-click-for-help events. The user is encouraged to position and size the help dialog box to suit his preferences and to not worry if it gets hidden because a new right-click-for-help will pop it right back up at the previous size and position.

This help system is much easier to use to quickly explore the help available for each gui control.

version 1.0.4

- Hover is now properly disabled so that help only appears with a right-click

#### version 1.0.3

- Changed the 'help' system from a 'hover to get help' to a right-click to get help.

#### version 1.0.2

- Fixed conversion of color image to grayscale image for avis: now processes YUV color space correctly.

#### version 1.0.0

- Added documentation: PyMovie-doc.pdf
- Pushed source code to git-hub for the first time
- Updated Windows PyMovie.bat file to require the user to press the Enter key to close the script. This keeps the prompt window open so that if anything went wrong, the diagnostic messages will remain visible. This file is created in [C:\Anaconda3](#) the first time PyMovie is run. However, we do not over-write an existing PyMovie.bat file, so if you want the updated file, then you must remove PyMovie.bat from [C:\Anaconda3](#) to force the re-creation of that file from the copy that comes with the package.

#### version 0.9.9

- made the gui font size 'OS aware' to try to make the Windows PyMovie gui look as good as the MacOS version. If you run on MacOS, you get a font size of 13 pts. That changes to 8 pts if you run on Windows

#### version 0.9.8

- modified the setup.py file so that scikit-image  $\geq 0.15.0$  will be automatically installed by pip if it is not already present in the Anaconda installation when PyMovie is installed.
- Added messages to the user that appear if the redact lines and/or num frames boxes associated with the Generate "finder" image button are left empty.

#### version 0.9.6

- added the ability (when working in the context of an AVI-WCS folder) to generate a "finder" image formed by registering and summing several hundred frames. An aperture placed on this image remains when the user switches to the avi. The user then adds a 'tracker' aperture, adjusts its threshold, and runs the analysis.
- to facilitate the use of 'finder' images (produced by stacking images), when a static aperture is added, its threshold is set very high so that it will be forced to use a default mask. An aperture that uses a default mask will not move on its own. So switching from the 'finder' image to the avi can be done without concern that your careful placement will change when the avi comes up.
- added crosshairs to all apertures, a nice visual aid, particularly in zoomed mode.

#### version 0.9.3

- the calculations for manual WCS calibration have definitely been 'fixed' .
- Miscellaneous small changes to GUI: labels on edit boxes for redact lines and plate scale; clear the VizieR response as soon as a change is made in UCAC4 box.

#### version 0.9.2

- the calculations for manual WCS calibration have been 'fixed' (we hope).
- added the ability to specify a plate scale to use for the manual WCS calibration. Any value entered in the box to the right of the the Manual WCS calibration button will used as the plate scale. But be sure to leave this box empty if you want the maths behind manual WCS calibration to estimate the plate scale from the calibration points provided; this is the normal expected use.

#### version 0.9.0

- same as 0.8.9 but added astroquery as a required package. This is used to make VizieR calls but is not a standard part of an Anaconda installation.

#### version 0.8.9

- this version adds manual WCS calibration. It is not yet very accurate likely due to the assumption that the RA Dec coordinate system covers a small enough area that the curvature of RA/Dec grid lines could be ignored --- this may not a good assumption. Currently a target aperture may be placed 2 to 4 pixels from the correct location (per nova.astrometry.net WCS calibration).

- Added the ability to get UCAC4 star coordinates through Vizier. This is in support of manual WCS calibration. If the star chart has UCAC4 annotations, it makes it much easier to do the manual WCS calibration process.

#### version 0.8.8

- analysis can now be run in reverse by setting the current-frame higher than the stop-at-frame. When such settings are used, running an analysis will process frames from current-frame down to stop-at-frame + 1. Then, if you set current-frame to 0 and run the analysis, frames 0 up to and including the stop-at-frame will be processed. Both the plotting routines and the csv write routine will reorder the data based on frame number so the section of data that has frame numbers counting down will be restored to its normal ordering. This somewhat unusual capability make it easier to deal with an video recording that has but a single star (no companion that can used for tracking) that is occulted strongly enough that it is only visible (and so can self-track) before D and after R. In this case, the R side can be better handled by running the analysis in reverse.

#### version 0.8.7

- WCS calibration through nova.astrometry.net now works for both AVI-WCS folders and FITS folders.

#### version 0.8.5

- adds an option for WCS calibration when AVI-WCS folder is used to hold observation video (or a link to one) through an on-connection to nova.astrometry.net

#### version 0.8.4

- removed the self.pointed\_at\_aperture = None statement in removeAperture method. Just trying stuff.

#### version 0.8.3

- still working on avoiding crashes while deleting apertures under win7. Added manual disconnect of slot/signals for the aperture before deleting it.

#### version 0.8.2

- another variation on deleting apertures, this time without the aperture.deleteLater() call.

#### version 0.8.1

- another attempt to squash the win7 crash-on-delete-then-run bug.

#### version 0.8.0

- added self.pointed\_at\_aperture = None when an aperture is deleted. This is a possible cause of referring to an aperture that has been deleted and thus causing a memory violation exception. Crossing our fingers on this one that it finally solves the win7 crash-sometimes-when-aperture-is-deleted problem.

#### version 0.7.9

- in another attempt to find a solution to the occasional crash that a beta tester has experienced when deleting an aperture, I changed from the use of removeItem(aperture) to aperture.deleteLater(). There was some chatter on the internet that this is a better/safer procedure.

#### version 0.7.8

- restored the automatic green property for a newly added aperture.

#### version 0.7.7

- fixes the 'jumping mask' problem that appears when 'use yellow mask as default' is in use.

#### version 0.7.4

- added code to ensure that when the yellow aperture mask is being used as the default mask that it is evaluated first whenever there is a frame change.

#### version 0.7.3

- returned the option of simply opening an avi file --- use the Open AVI file button.

- Now there is a new button labelled Select AVI/WCS folder for when the user wants to utilize the WCS calibration capability of PyMovie. They will need to create a folder specifically for that purpose. In that folder they will need to place either the avi file to be processed or a shortcut (Windows) or alias (Mac) to that file (so the user does not have to relocate his avi just to satisfy PyMovie). This folder will hold star position and wcs calibration data unique to frame 0 of the avi. As before, this folder will be the default location for csv files and (in the future) png dumps of lightcurve plots.

#### version 0.6.9

- changed to requiring the use of a folder per observation. In that folder must be exactly one avi and related information such as a little file that gives the target coordinates in Ra and DEC. It also holds the WCS calibration data (if the user has asked/created one) that is used to place a target aperture 'blind' on frame 0. This folder will be the default location for csv files and (in the future) png dumps of lightcurve plots.
- finally found bug that was causing confusing thumbnail updates. Should be better now.

#### version 0.6.8

- tightened up the spacing between GUI elements to provide more vertical space for text box
- changed labelling of mask threshold spinner

#### version 0.6.7

- rearrange items on GUI to allow for large Clear plot data button
- added 'hooks' for experimenting with WCS/astrometry.net
- fixed issue where Thumbnail One was not always synchronized with Thumbnail Two (probably)
- made thumbnail display policy the same whether stepping through or running an analysis

#### version 0.6.6

- new policy: all newly created apertures default to having auto-display enabled.
- to control which of a group of apertures, all with auto-display ON, has its thumbnail dynamically updated during an analysis run, a property was added to make a specifically chosen aperture be the source for Thumbnail One. There will be either one or no apertures with this property set, enforced by the program. Should there already be an aperture with this property set and you choose a different aperture as the Thumbnail One source, the earlier aperture automatically has this property unset.
- added a warning when a user had been using a RegiStax star locator bitmap and failed to set at least one yellow tracking aperture in the aperture constellation before trying to open the avi or fits file for the observation. Failing to do this will cause the carefully set relative positions of the apertures to be lost as the observation video is read and the apertures all try to 'snap' to 'better' positions, something that is prevented if there is a yellow aperture in the set which locks the apertures together in a rigid constellation.

#### version 0.6.4

- with the success of 'dynamic' aperture display, we have adopted a policy when creating an aperture of setting all its special properties (jogging and auto-display) OFF and NOT touching the properties of any already-in-place apertures. In the previous version, adding an aperture caused all special properties in existing apertures to be cleared (quietly --- this adds to confusion --- didn't I just set that?) and the new aperture came preset with jogging and auto-display ON. In this version, it is up to the user to set the special properties and they will never be quietly changed.

#### version 0.6.3

- added 'dynamic' aperture display. If the mouse cursor is placed over/in an aperture, its stats and thumbnail are displayed, regardless of its auto-display setting. This is active during an analysis as well so that any aperture can be examined/viewed during a 'run' simply by pointing at it.

#### version 0.6.2

- changed the mask for a white aperture to have a black border. This is visually clearer as to what is going and avoids the 'complaints' from within the pyqtgraph histogram widget when all pixels have the same value
- added a 3D display (rotatable and zoomable by left and right mouse drag) for the Thumbnail One image.

#### version 0.4.8

- now, if you put your cursor on an aperture, the name and major properties of the aperture appear in the status bar in the very bottom left corner of the GUI

#### version 0.4.6

- added the name of aperture to its context menu --- appears at the top of the right-click menu
- added ability to use arrow keys to jog apertures. Each aperture has a flag to enable it to respond to an arrow key, so apertures could be manually jogged as a group should that be useful. When an aperture is added, it is born 'joggable' and with 'auto-display'
- Eliminated the 'green' mode for an aperture. Now each aperture can request that its stats be printed at each frame change. There is only one thumbnail display however so only the last aperture in a group that gets printed will have its thumbnail displayed.
- Added cross hairs to thumbnail One to aid in manual positioning of apertures.

#### version 0.4.5

- removed debug printout from Demo Robust
- added auto-naming to no-snap aperture creation (just overlooked it earlier)
- ThumbNailOne no longer uses log scaling. Instead, it uses whatever scaling is in force for the frame image.

#### version 0.4.4

- added button to read a bmp file, assumed to be a star locator. Any apertures positioned on this image will be preserved when the avi file is opened.

#### version 0.4.3

- made it unnecessary to close the image range control for level changes to be reflected in subsequent frame changes

#### version 0.4.2

- the 'no snap' aperture was actually 'snapping' --- that's been fixed
- added a demonstration plot to let the user see visually what the robust mean and std calculations are doing.

#### version 0.4.1

- made the changes in image display through use of the image range control 'sticky' so that any changes made apply to all images going forward
- changed the number of pixels plot to use lines only (no circles at the data points) and show the negative values (from a default aperture) as positive. It's easier to look at and the data plot above clearly identifies data points that were obtained using a default mask. The redundancy was not needed or useful

#### version 0.4.0

- added an image range control to give user complete control over image 'stretching'. This is a visual effect only as an aid to identifying stars --- it does not affect any underlying data values.
- Added an 'invert images' checkbox to make it easy to switch between avi and fits files with their differing convention of the image origin (fits: lower left corner; avi: upper left corner)

#### version 0.3.9

- added fast navigate buttons to speed going forward and backward through images
- now the text box gets cleared when a new image file is successfully opened
- changed the way apertures are deleted in support of chasing a pesky sporadic crash when apertures are deleted
- add a spinbox to allow the user to select the plot symbol size --- it's set by a spinbox that is 'sticky'
- some rearranging of GUI elements
- changed label on threshold box to help user understand better what a value in this box means
- added a legend to the composite lightcurve plot to identify the curves

#### version 0.3.8

- added a try/except block around aperture delete code to see if we can track down crashes that are occurring sporadically under Win 7 OS (but not Mac or Win 10)

#### version 0.3.6

- made the log scale image checkbox 'sticky' so that PyMovie can 'adapt' to your preferred image view.
- removed white apertures from the aperture constellation during tracking so that it/they will remain fixed on the image wherever you originally placed it/them.

#### version 0.3.5

- fixed double yellow tracking that was accidentally broken by a change introduced in 0.3.4

#### version 0.3.4

- added timestamp printout when running fits files with DATE-OBS in fits metadata
- initialized timestamp correctly

#### version 0.3.3

- added timestamp extraction from 'fits files under the assumption that they came from a QHY-174M-GPS. This completes PyMovie for users of the QHY-174 that record in int16 fits files.

#### version 0.3.2

- added the option of a 'white' aperture to be used when flash-tags have been recorded in the video. The special thing about a white aperture is that all the pixels in the aperture are summed (without background subtraction) and output as the 'signal' for that aperture.

#### version 0.3.1

- field processing of avi files now operational

#### version 0.3.0

- fixed tracking during wind shake (accidentally broken in 0.2.9)
- now we enable/disable controls that are specific to avi versus fits file processing
- added printout of frames per second read from avi files
- added ability to view both fields of an avi frame
- added update of default mask when aperture size is changed to solve the mask/thumbnail shape mismatch exception from occurring
- added aperture constellation tracking during manual (frame spinbox) changing of frame. It was confusing to have aperture constellation tracking only active during a 'run'

#### version 0.2.9

- added the printing of the FOURCC codec ID extracted from avi files that could be opened. This may have diagnostic value in some case where an unusual codec was employed. PyMovie handles Lagarith compressed files without issue and without the need for the user to separately find and install a Lagarith codec.
- Added the controls for dealing with field level avi stuff --- no code behind the controls yet
- found a way to do random access reading of an avi file so it is no longer necessary to read the entire file into memory!! (which has been a real problem)

#### version 0.2.8

- generalized the display of FITS metadata to show the header data (metadata) from the current frame rather than just frame 0
- rearranged the columns in the csv file so that all signals appear starting in the column following time stamp data. R-OTE and PyOTE can read this file format.

#### version 0.2.7

- changed the snap-to-blob function to require user to place cursor on/near star of interest. Previously, snap-to-blob snapped to the brightest star in the entire aperture UNLESS there was already a yellow



aperture defined. This seemed overly complicated, hard to explain, and causes the behavior to be sometimes mysterious, particularly if one forgets whether or not there is a yellow aperture. Requiring cursor placement within 6 pixels of the star-of-interest at all times is easier to get used to and allows a dim star that has bright neighbors to be easily singled out.

- The aperture name dialog now pops up whenever an aperture is created. This save mouse clicks and encourages good practices.
- The title on the Number of pixels plot has been expanded to clarify the meaning of negative mask pixel counts.
- Removed Inc threshold and Dec threshold menu items from the aperture specific context menu. The Inc and Dec functions are more clearly handled by the spinbox on the main GUI window.

#### version 0.2.6

- added PyMovie-info.pdf to the distribution (to make the About button work)
- added opencv-python to the required packages list so that Anaconda installations that lack this package (known as cv2) will have it automatically added
- increased the allowed distance of computed masks from aperture center from 4 pixels to 6 pixels (this only comes into effect when there is a yellow aperture present)
- set thresh = 0 when aperture is created rather than None to deal with cases where an aperture is added where there is no image

#### version 0.2.5

- Initial Beta release – no timestamp OCR – functional for lightcurve extraction