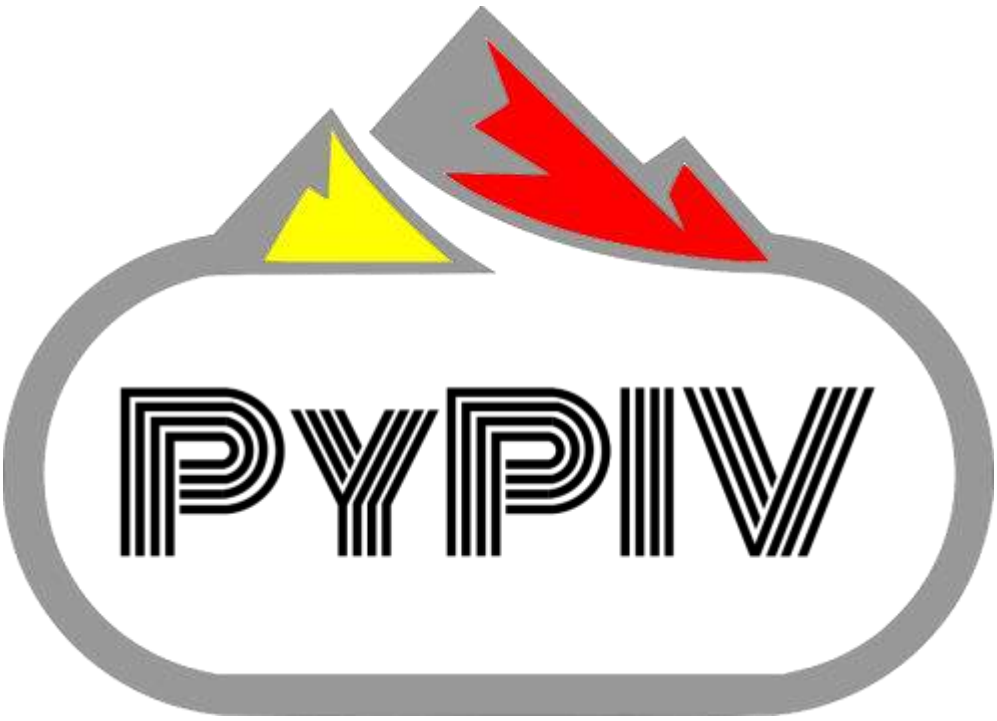

Instruction Manual

Version 1.0 (09/2022)

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Introduction

Free open-source software PyPIV (Python Particle Image Velocimetry) was designed to evaluate kinetic fields for granular media such as sand. The software was developed and tested with Python 3.6.

1. Program Structure

The program initiates after running the *PyPIV.py* file, located in the root program folder (Figure 1). It is recommended to put the analyzed images in the *imgs* folder. Exported data (images, text files) can be found in the "export" folder, while the project data and settings of the graphical user interface (GUI) are saved in the *saved_projects* folder.

Figure 1: Structure of the program folders and files.

2. Running *PyPIV.py*

After running the PyPIV program, a simple GUI with all controls opens (Figure 2). The user is required to either create a new project (by importing images: *File -> Import Images*) or to load one, after which setting a region of interest (ROI), scaling, and analysis settings become available (Figure 3). Note that when drawing ROI, the left-mouse-button click adds a point of the ROI polygon, while the right-mouse-button click deletes the previous one, and pressing the ESC key saves the ROI (Figure 4). The calculation grid can be displayed by selecting the radio button *Grid* (Figure 5) and adjusted using the inputs for *Subset size* and *Subset spacing*.

Before running the analysis, it is recommended to scale the images (pixel-to-mm ratio) and set the analysis parameters (Figure 6): *Frame period* (how often the frames were taken during the experiment), *Subpixel accuracy* (precision of the correlation algorithm), *Backward analysis [yes/no]* (the last image in the sequence becomes reference), and *Update subset position [yes/no]* (whether the subsets follow the displacements (suitable for large displacements) or stay at a fixed location during the analysis (to avoid the potential accumulation of errors). The results can be viewed for each image in the sequence in the form of a *Quiver plot*, a *Contour plot* for horizontal and vertical velocity components, and a deformed grid by selecting the *Subsets* radio button (Figure 7).

Figure 2: GUI of PyPIV after running the program.

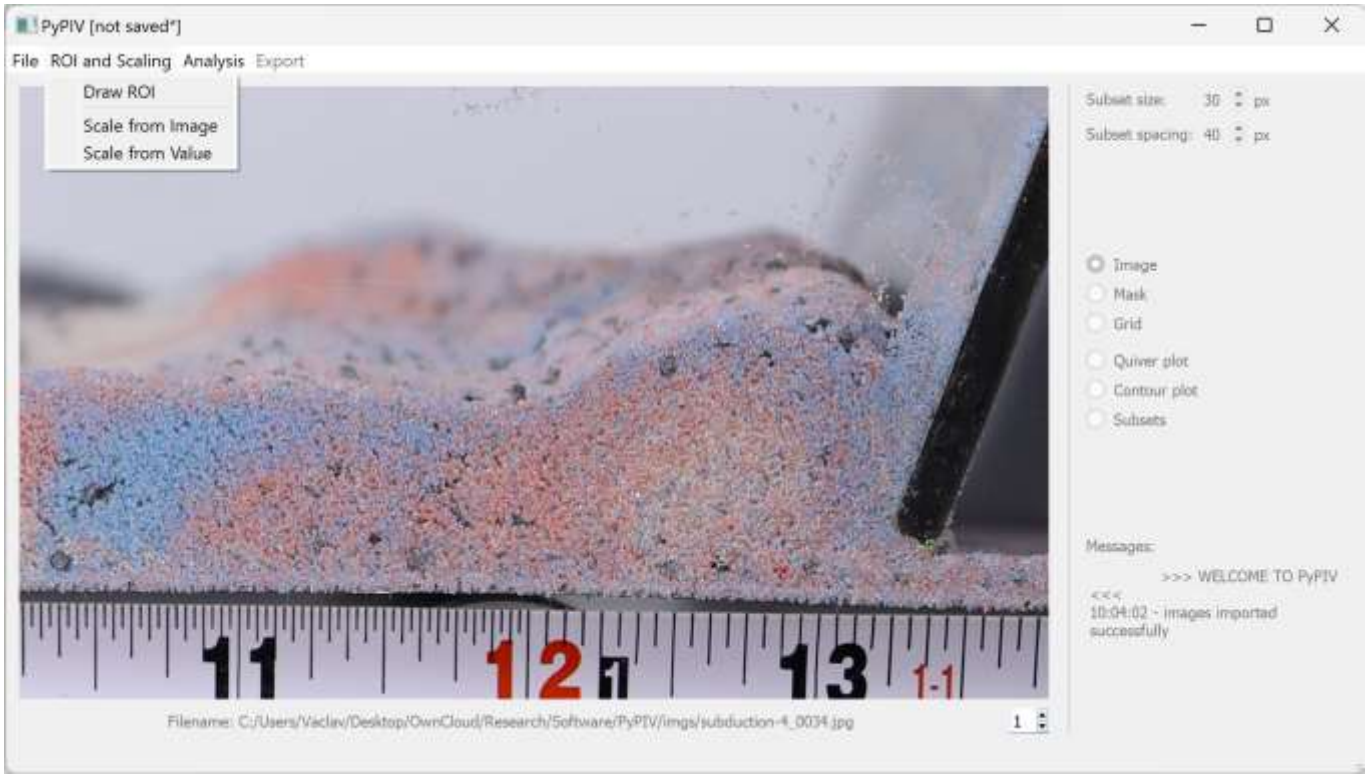

Figure 3: GUI of PyPIV after loading the images.

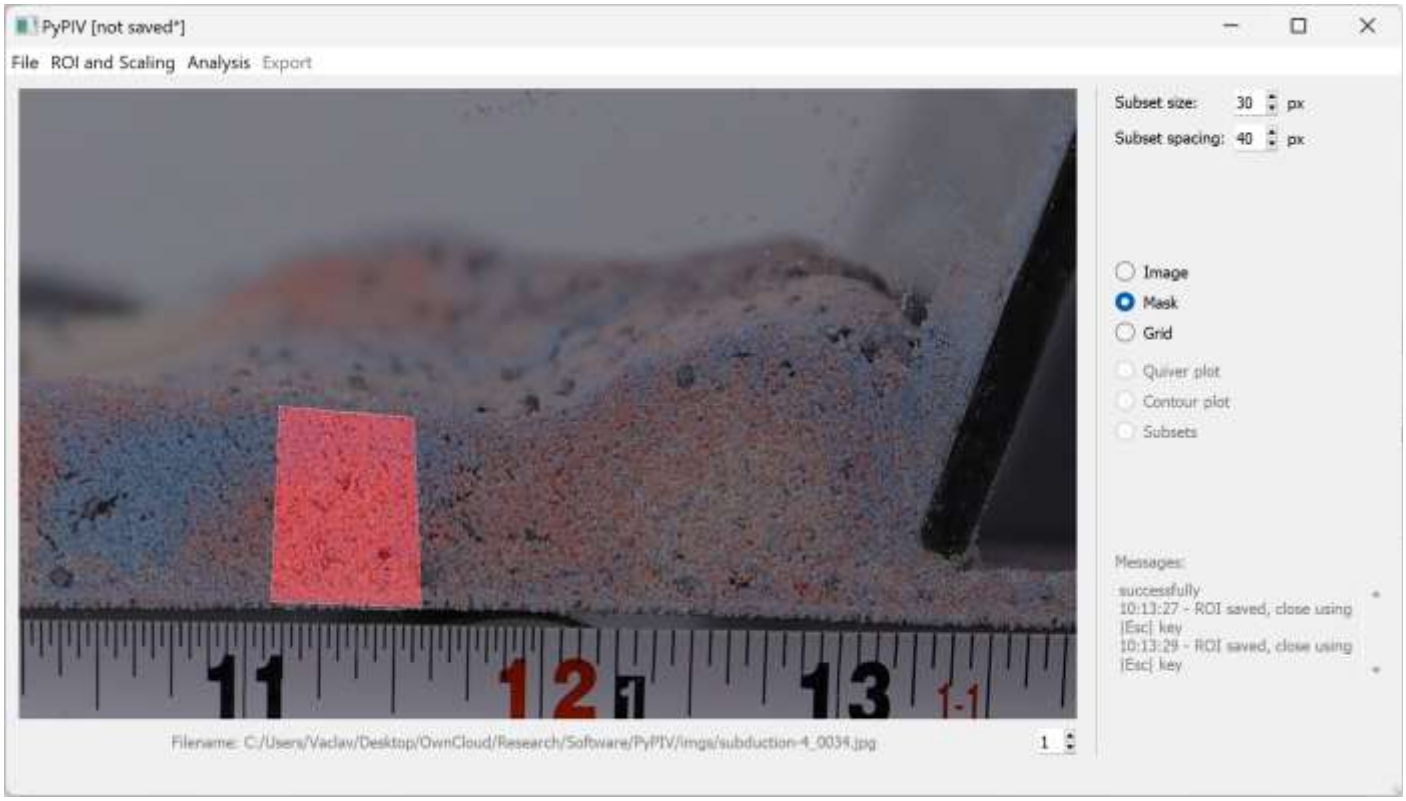

Figure 4: Selected ROI for calculation of kinetic fields.

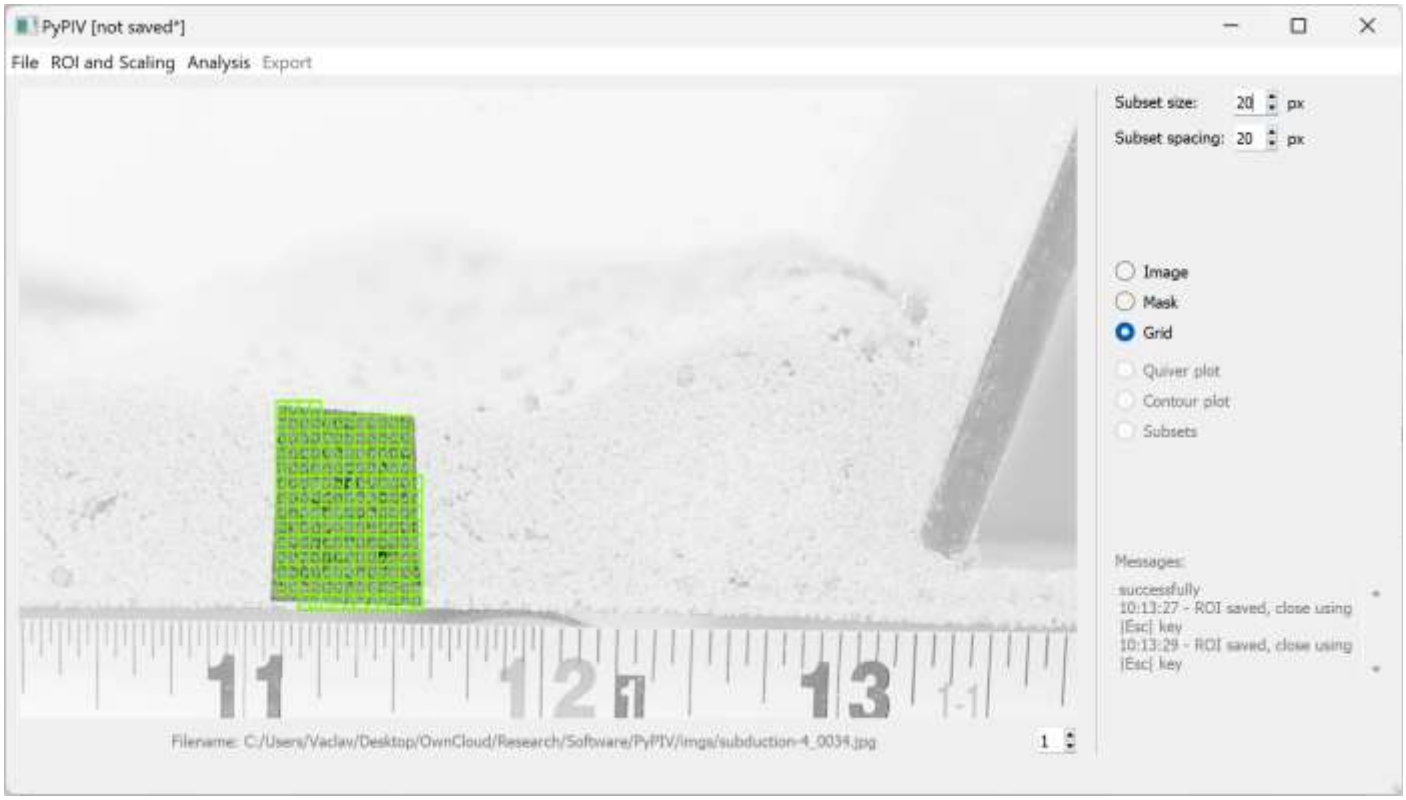

Figure 5: Displaying the calculation grid.

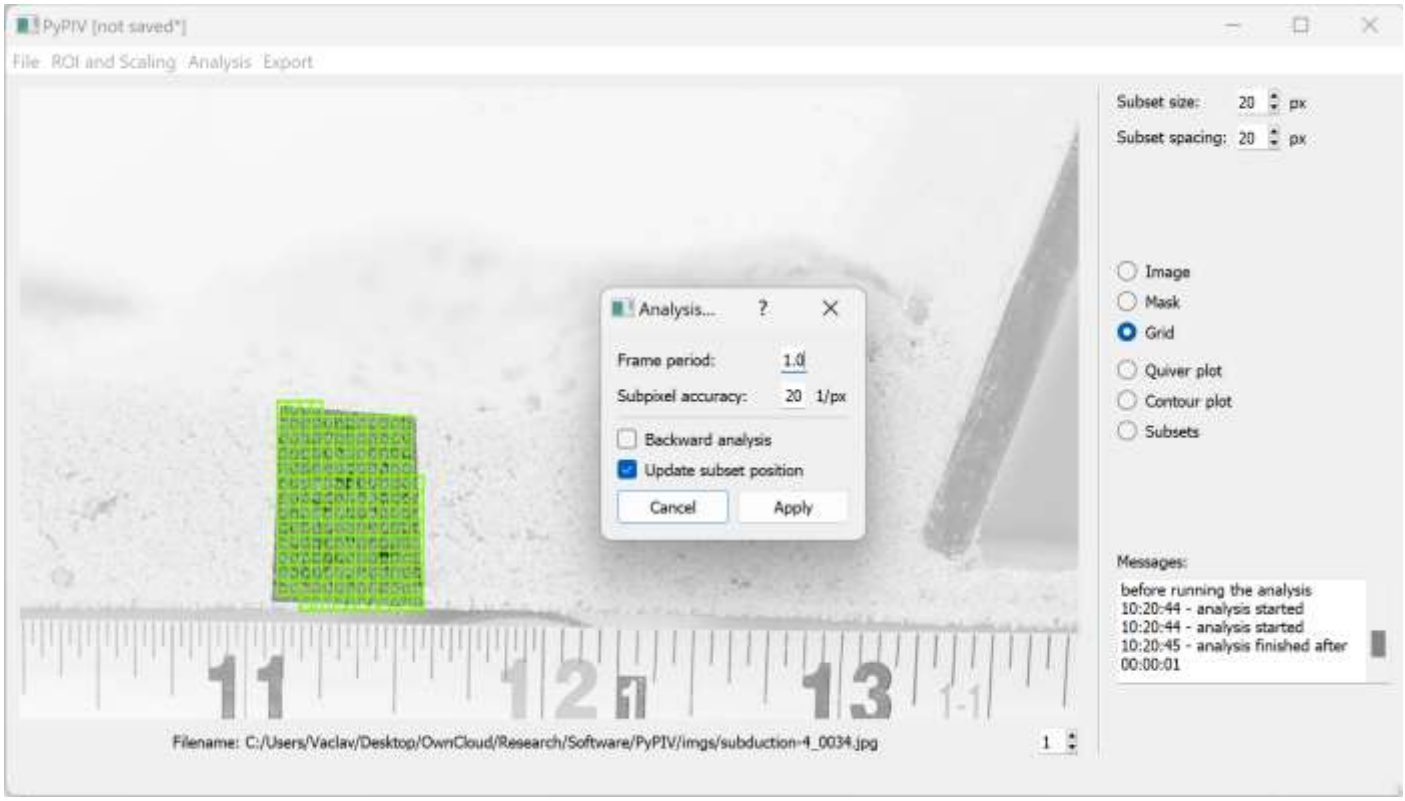

Figure 6: Setting of analysis parameters.

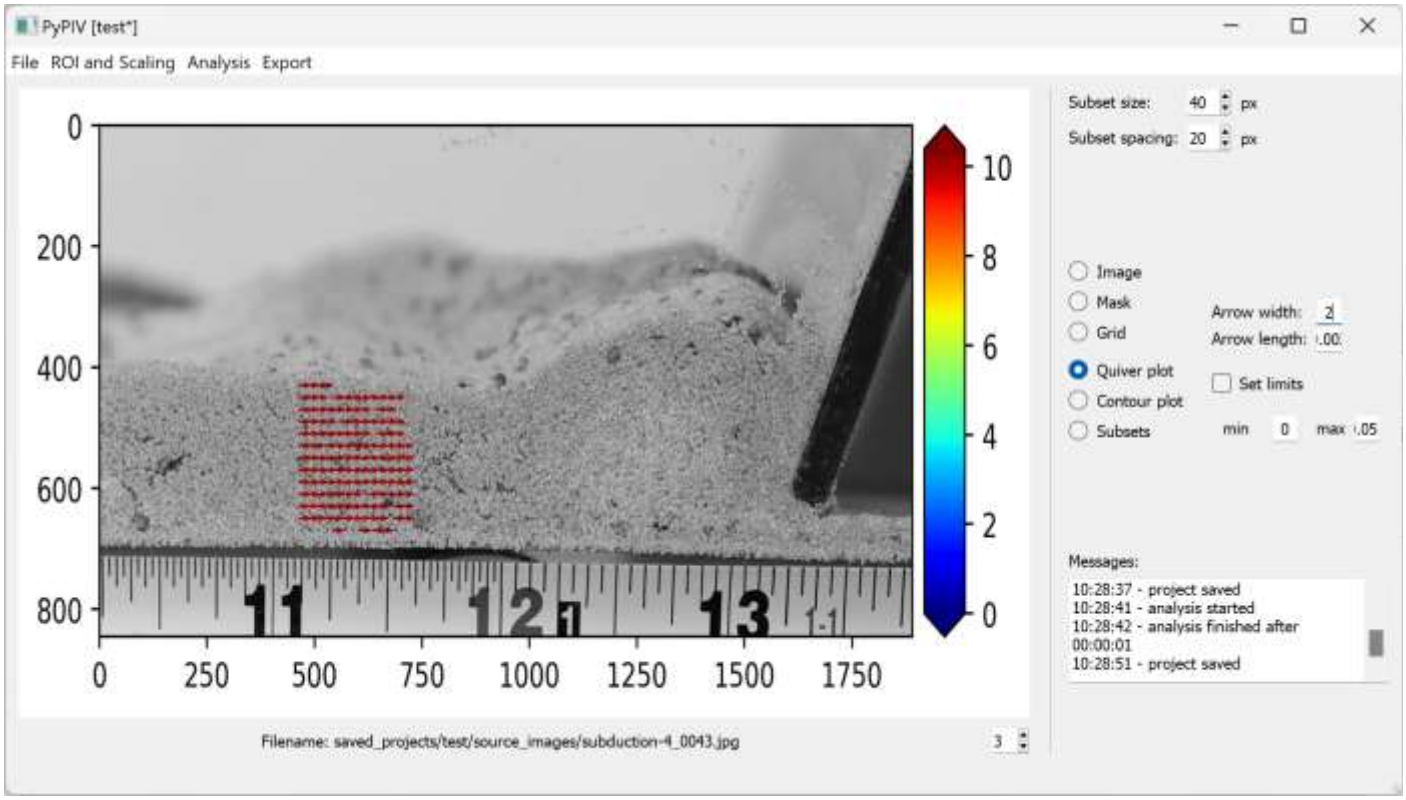

Figure 7: Displaying results.

Acknowledgment

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