

Motorized Thermal Camera Slider for Oral Cancer Detection

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Work in Progress

In collaboration with **HT** BiImaging

Introduction

- HT BiImaging is currently developing a technology for early detection of oral cancer.
- A camera is mounted next to the patient's mouth and acquires thermal video.
- The thermal camera needs to be focused for accurate results.



HT system

Goals

- Developing a system that consist of:
 - A Mechanical slider that will accurately move the camera.
 - An algorithm that determines the optimal camera position.

Challenges

- There are only a few studies on focusing thermal cameras.
- The solution includes algorithmic and mechanical elements, control devices and integration with HT proprietary system.

Mechanical Slider

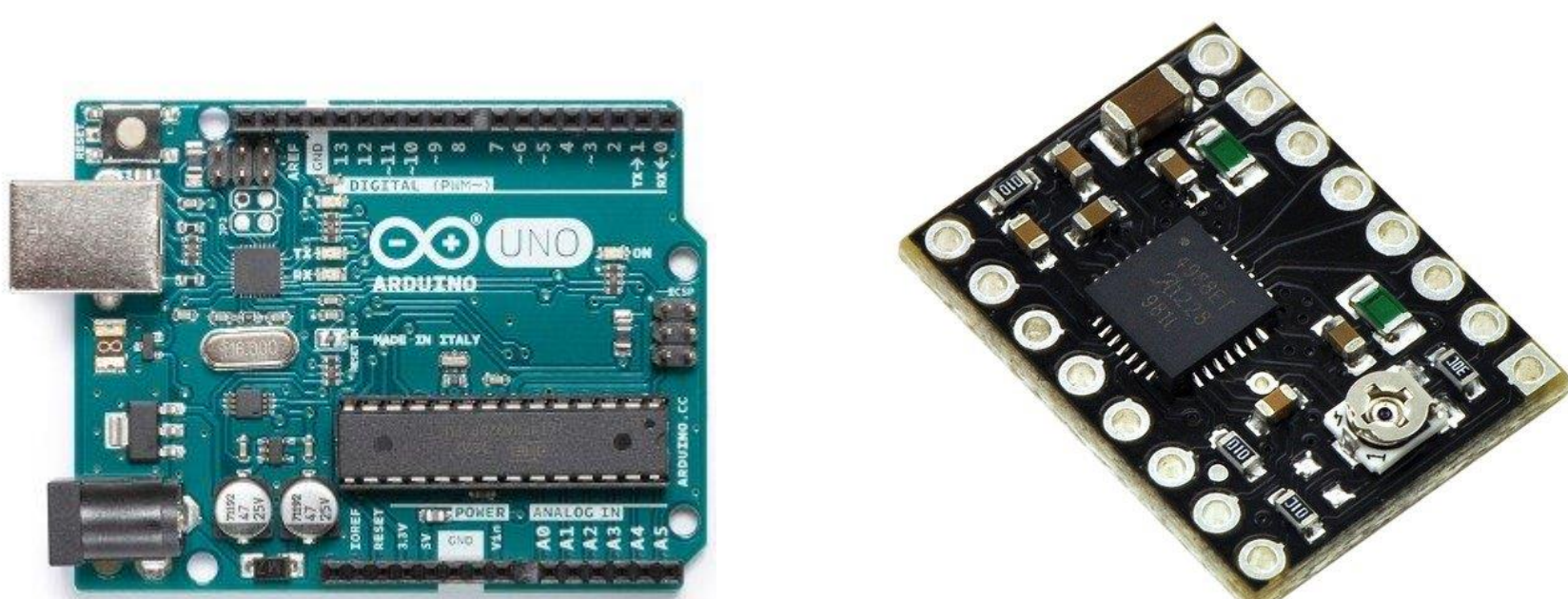
- Uses a stepper motor and a screw drive to accurately move the camera:



- fitted to a custom-made slider:

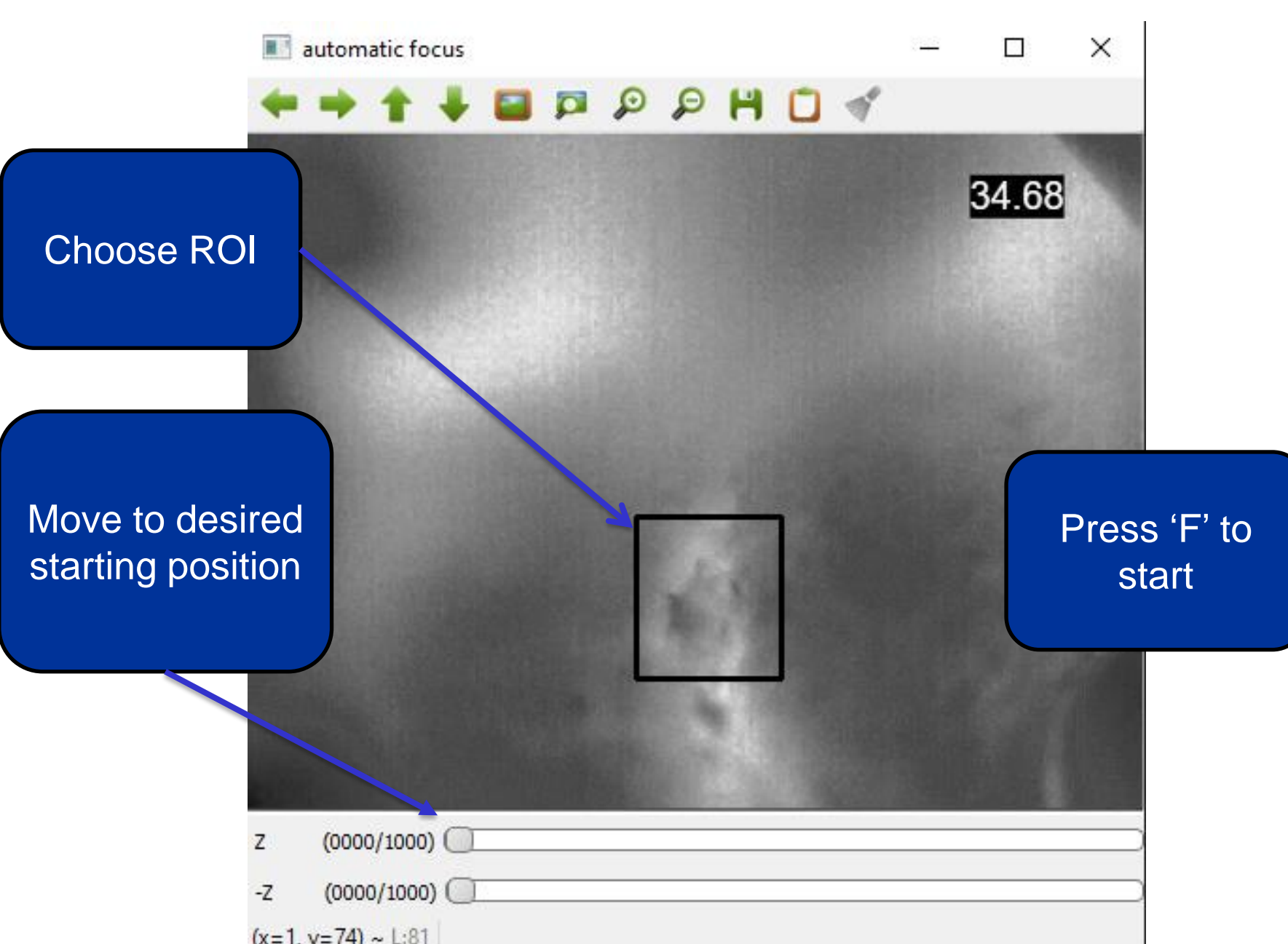


- Uses an Arduino uno and an A4988 stepper motor controller, to control the motor:



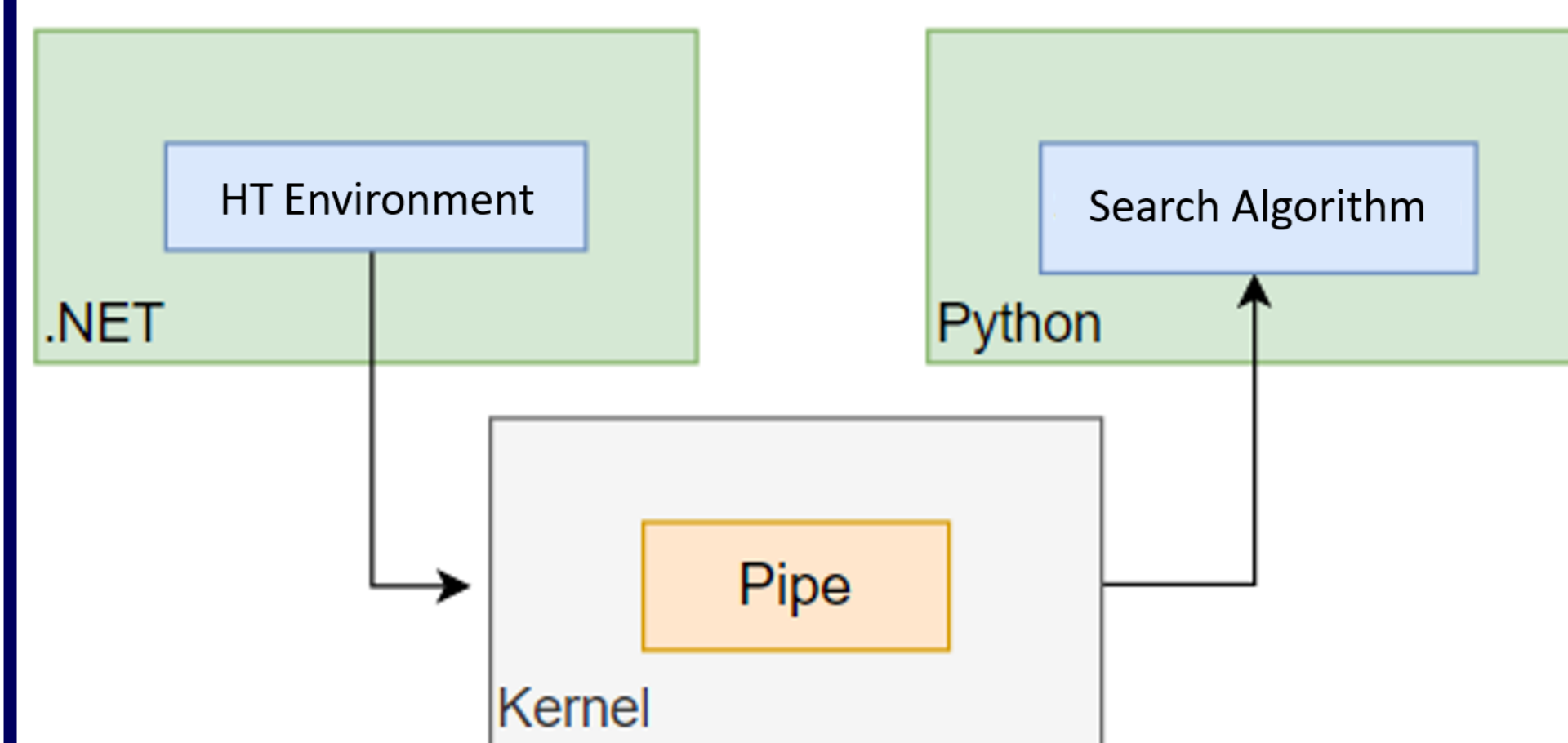
Control UI

- Using CV2 library in python



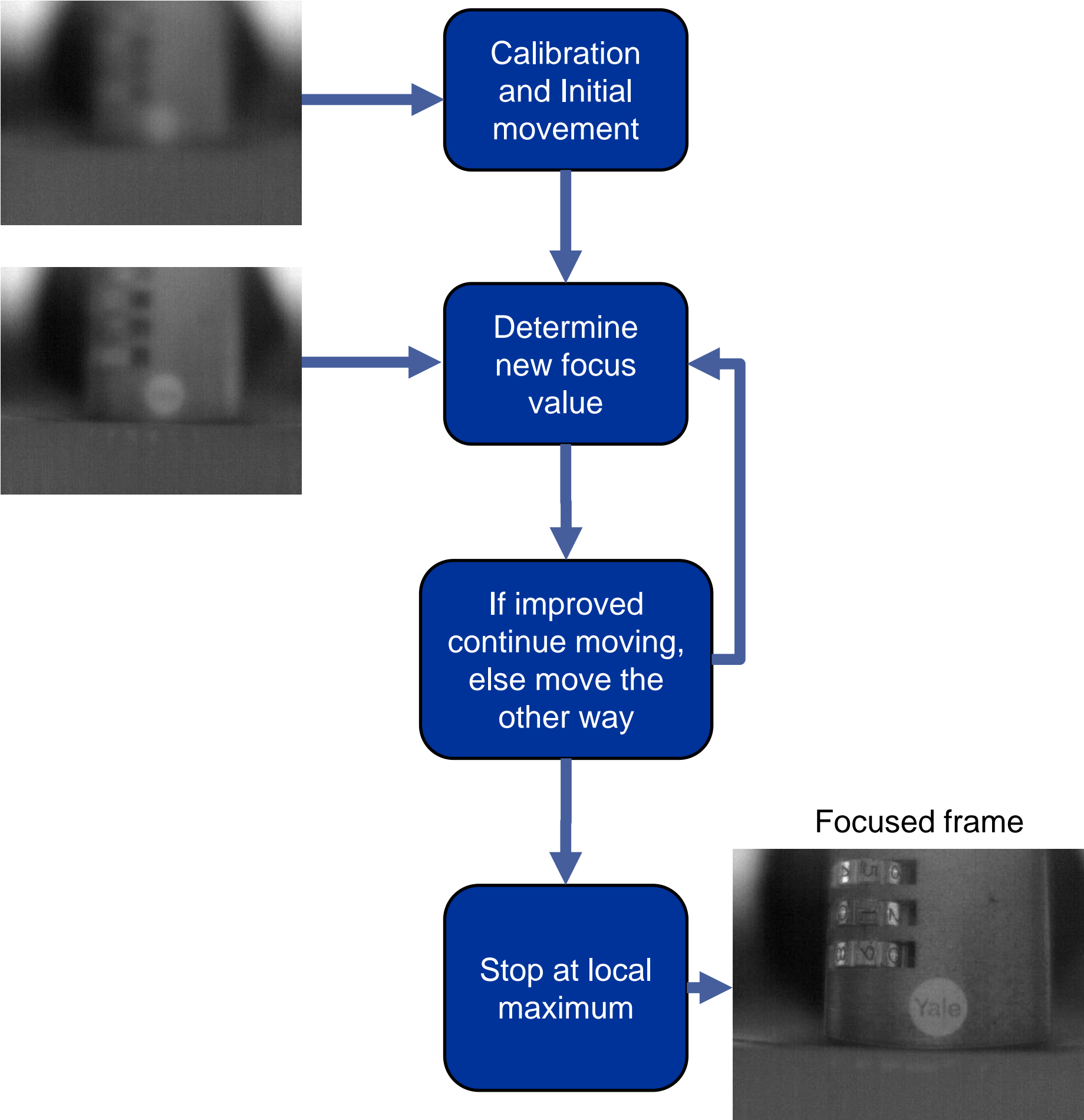
Integration With HT Camera

- Using a named pipe:

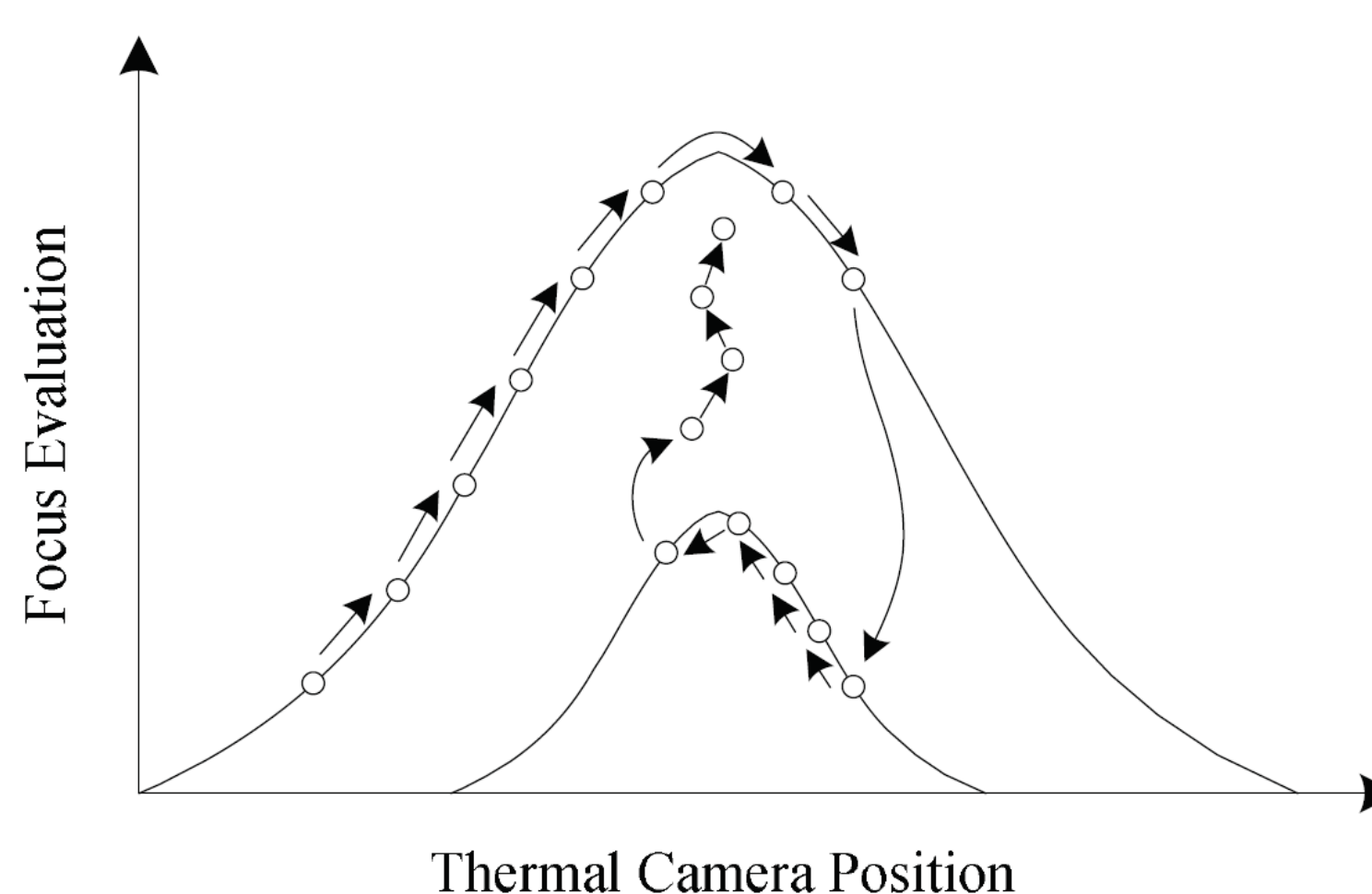


Search Algorithm

Input frame from the camera

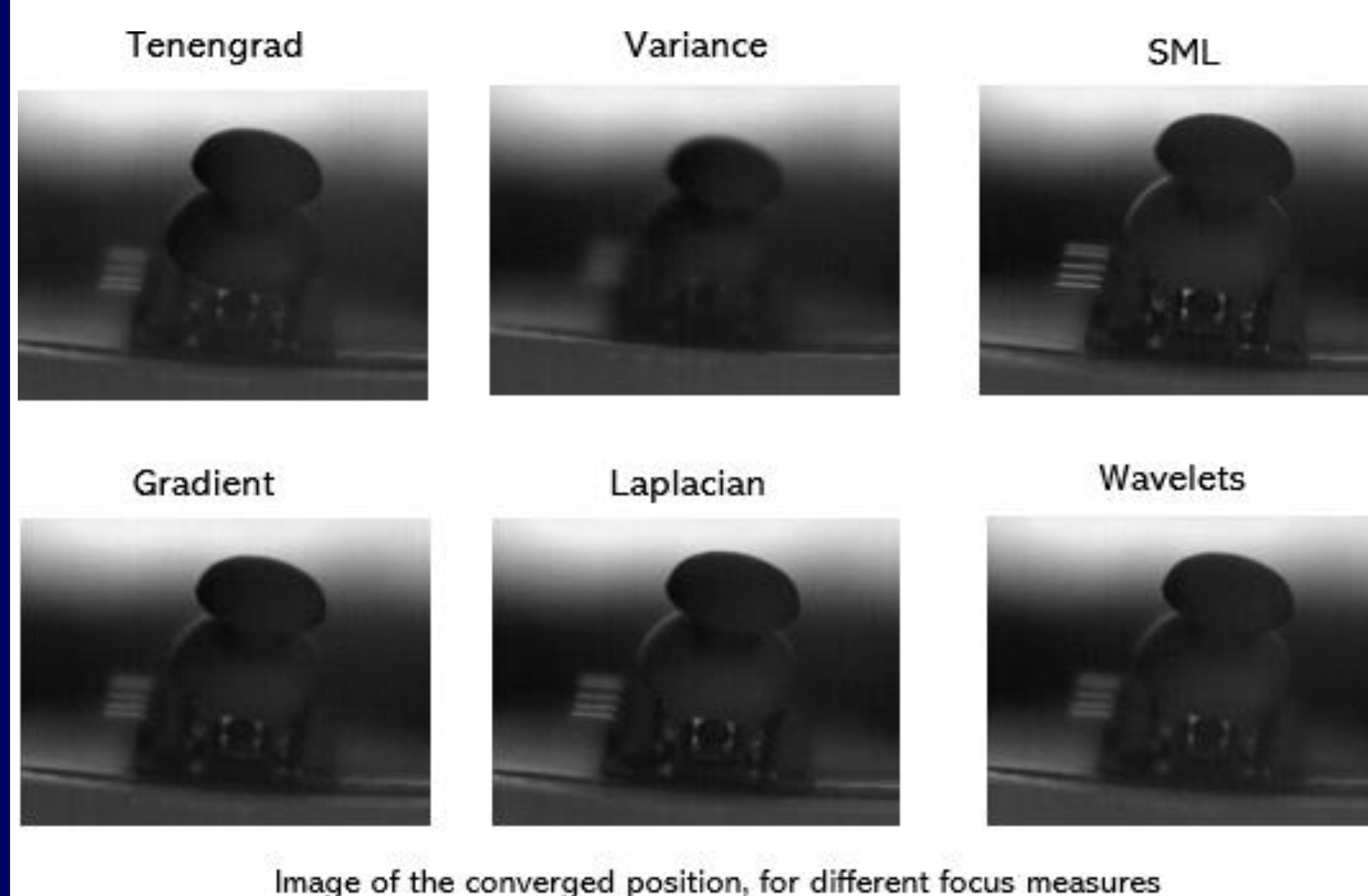
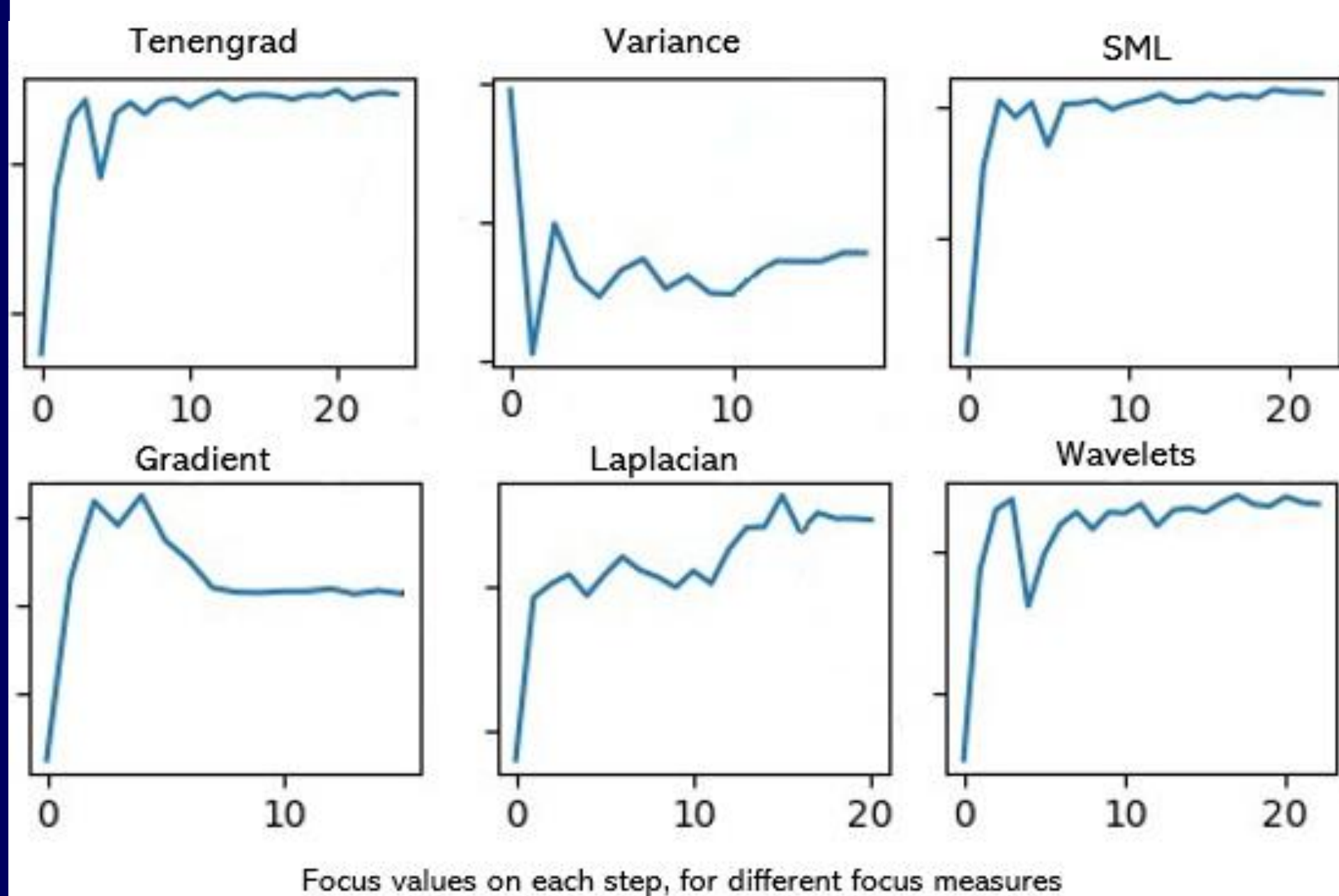


- Visual Illustration:



Results

- The algorithm converge reliably as long as the initial camera position is not too far from the focus distance.
- Algorithm results using HT's camera and the slider:



Focus Measures

- Different focus measures are used to find the best camera position:
 - Probability based: *Variance*
 - First derivative based: *Tenengrad, Gradient*
 - Second derivative based: *Laplacian, SML*
 - Frequency domain based: *Wavelets*

Conclusions

- Successful focus of HT's camera.
- Tenengrad, Laplacian and wavelet proved are the most effective measures for HT's camera.
- The mechanical slider accurately moves the camera.
- A smaller, lighter and portable slider is needed.