

UNITAC AI BUILDING TRACKER MANUAL

(UNITAC-Hamburg – last updated 12/05/2022)

This guide is intended to take new users of the tool through the steps required to detect buildings in aerial photography and store the results in shapefiles that can then be used in GIS-tools such as QGIS or ArcGIS.

1. Installing Prerequisites

For the tool to work, you need to install the following software before proceeding with any of the other steps:

1.1. CUDA

While the tool is capable of running on a CPU, at least one GPU is required for the process to run at an acceptable speed. The GPUs will need to support the parallel computing platform and application programming interface CUDA. You can find a full list of such GPUs [here](#) (and then under “CUDA-Enabled GeForce and TITAN Products”). Please bear in mind that you should have at least 8 GB of VRAM to run the tool at an agreeable speed.

Two recommended GPUs are

- [NVIDIA GeForce RTX 3060 12 GB RAM](#) – Compute Score 8.6
- [NVIDIA GeForce RTX 2060 12 GB RAM](#) – Compute Score 7.5

Please download CUDA 11.3.0, which was tested with the tool, here:

<https://developer.nvidia.com/cuda-11.3.0-download-archive> (an alternative download link from the HCU cloud can be found here: <https://cloud.hcu-hamburg.de/nextcloud/s/rqHCYzx7zafP93q>)

On the CUDA website, please choose Windows as your Operating System, x86_64 as the architecture, Version 10, and exe (local) as the Installer Type and then on the download link at the bottom right (all marked in red below).

Select Target Platform

Click on the green buttons that describe your target platform. Only supported platforms will be shown. By downloading and using the software, you agree to fully comply with the terms and conditions of the [CUDA EULA](#).

Operating System: Linux, Windows

Architecture: x86_64

Version: 10, Server 2016, Server 2019

Installer Type: exe [local], exe [network]

Download Installer for Windows 10 x86_64

The base installer is available for download below.

>Base Installer

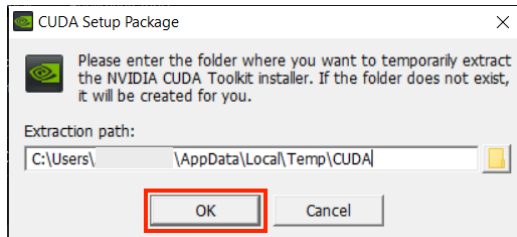
Download [2.7 GB]

Installation Instructions:

1. Double click cuda_11.3.0_465.89_win10.exe

Please run the 2.7GB large installation file named “cuda_11.3.0_465.89_win10.exe” after its download is completed.

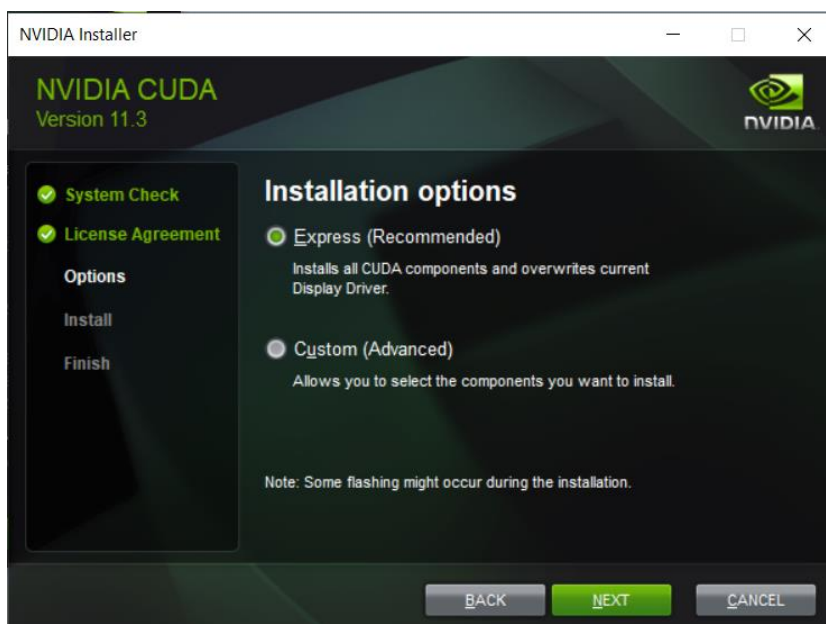
Confirm the default folder chosen to extract the installer files by clicking on “OK”.



Next, you need to accept the license agreement by clicking on the green “AGREE AND CONTINUE” button.



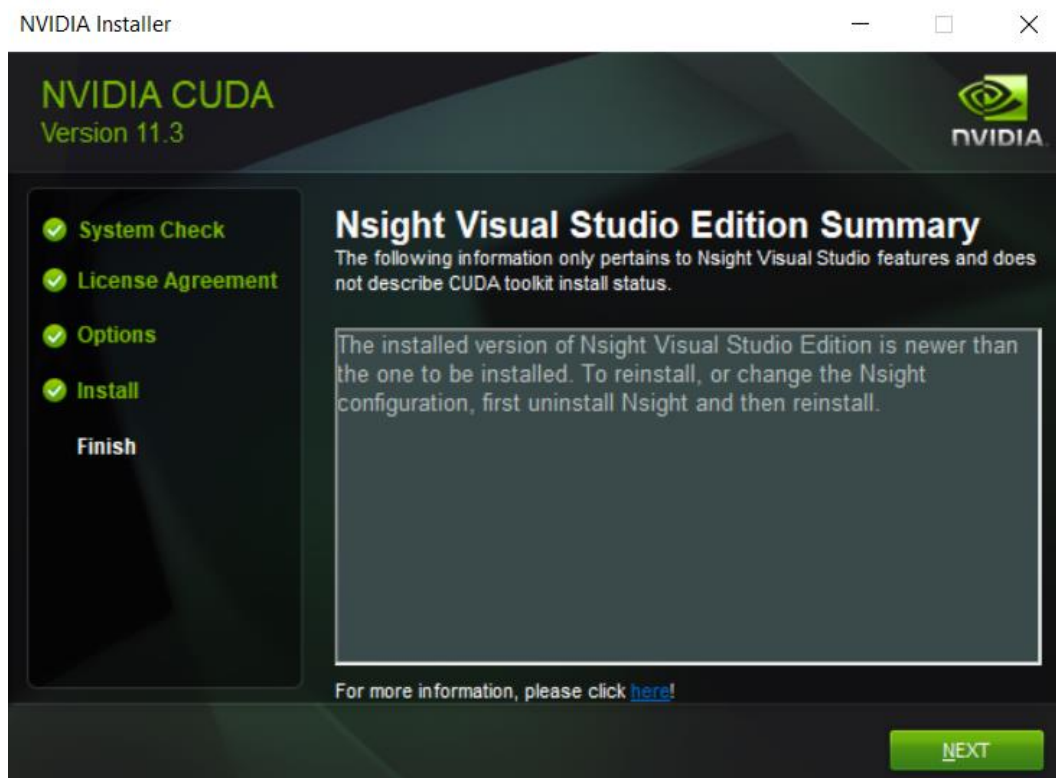
You can keep the default installation option “Express (Recommended)” and confirm by clicking on the green “NEXT” button.



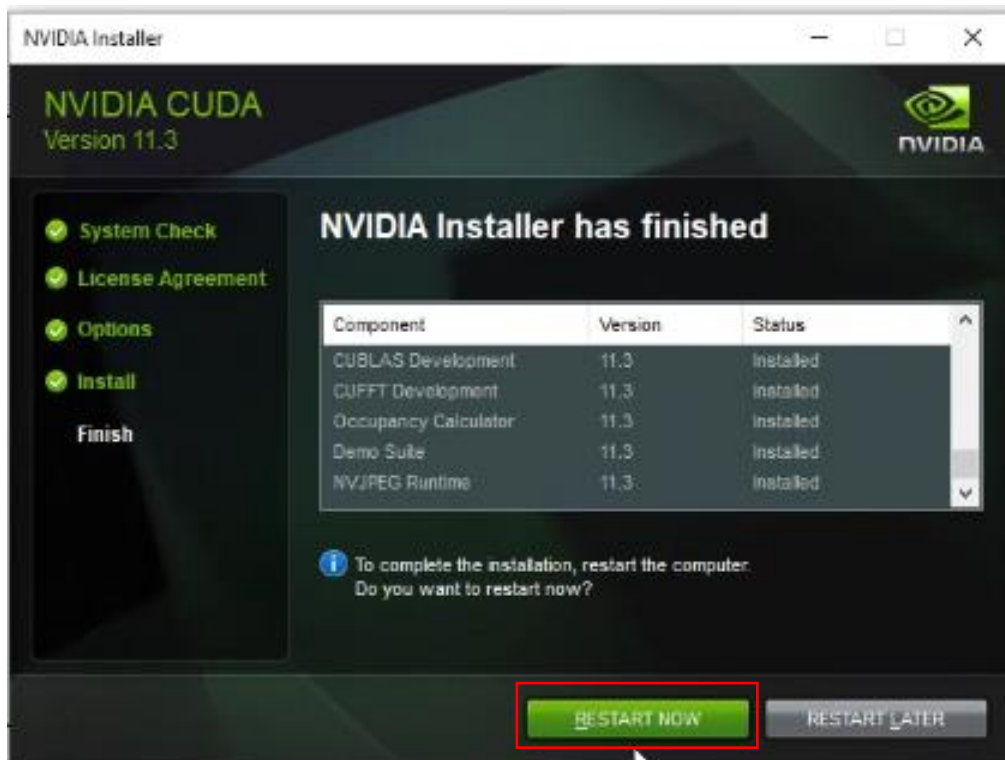
You need to now tick the box confirming that you would like to proceed without a supported version of Visual Studio and click on the green “NEXT” button once more.



If a window about “Nsight Visual Studio Edition Summary” pops up, please also click the green “NEXT” button. CUDA will now be installed.



Once the installation is finished, you have to restart your device by clicking on the green “RESTART NOW” button.



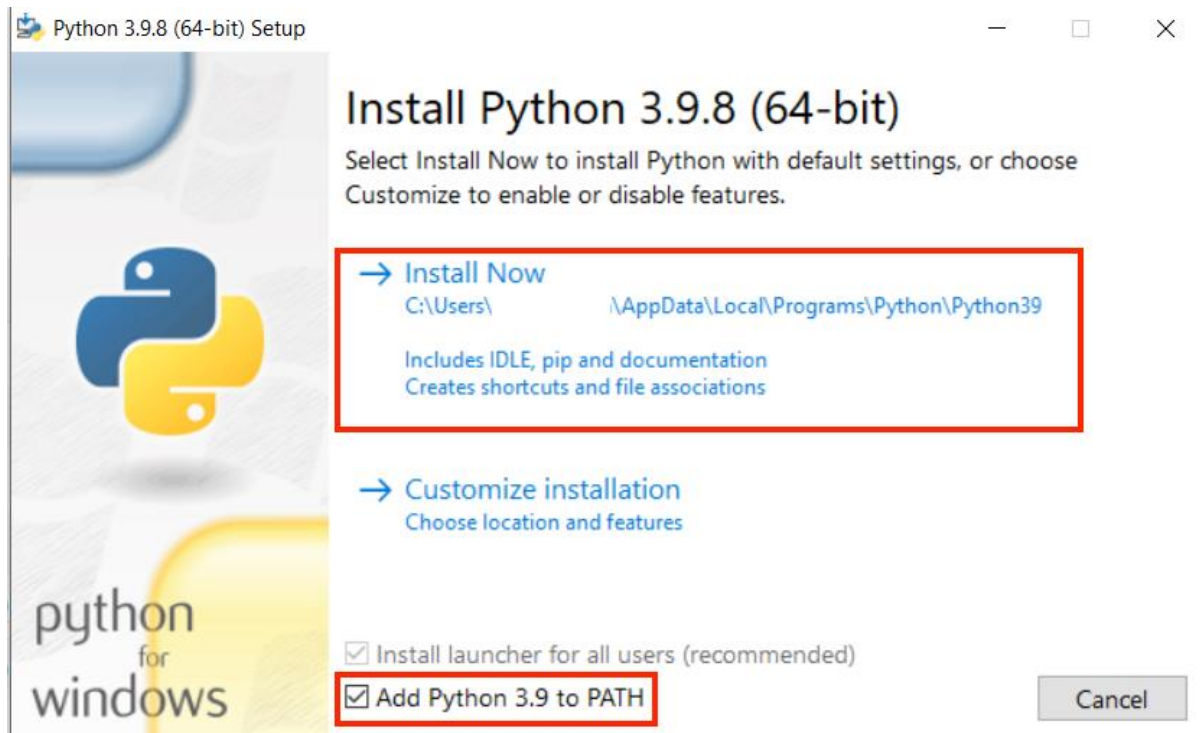
1.2. Python

If you have not already installed it, you will now need to install Python from this link: <https://www.python.org/downloads/release/python-398/>.

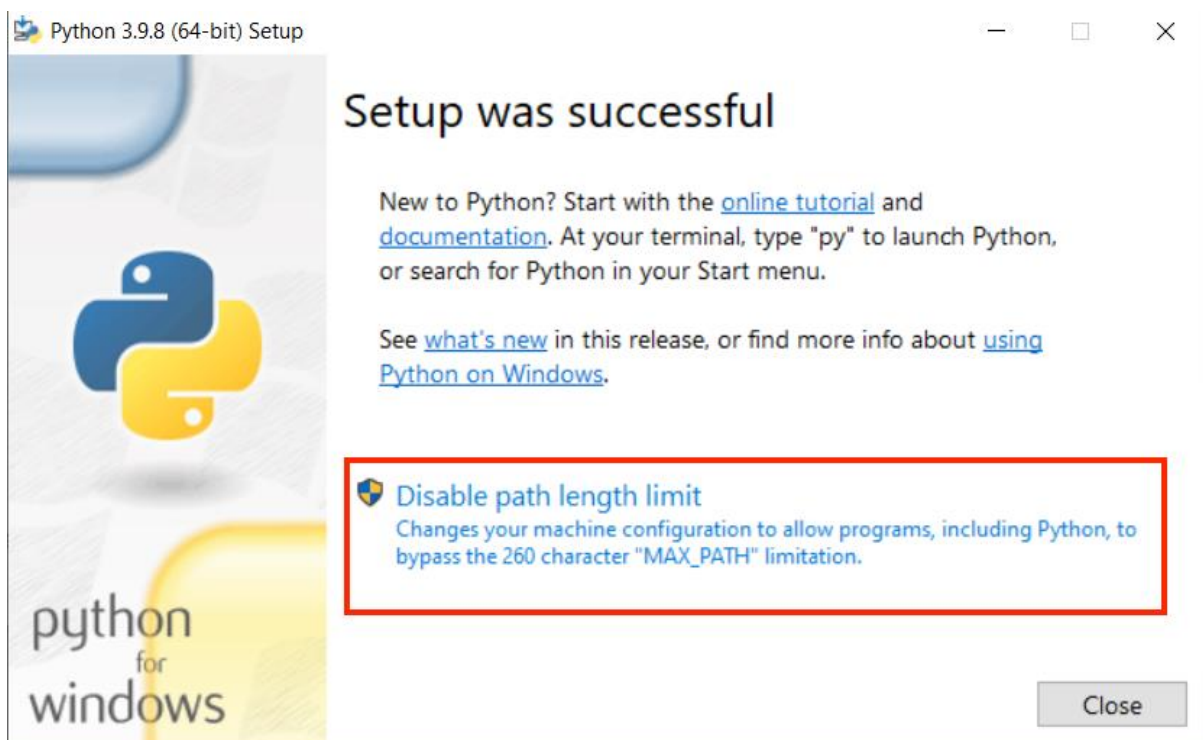
For compatibility reasons, please ensure that you download version 3.9.8 as it has been tested to work with the tool. Download the installation file called “python-3.9.8-amd64.exe by clicking on “Windows installer (64-bit)” at the very bottom of the window.

Files					
Version	Operating System	Description	MD5 Sum	File Size	GPG
Gzipped source tarball	Source release		83419bd73655813223c2cf2afb11f83c	25790162	SIG
XZ compressed source tarball	Source release		d4875c1832c8f757280794f6d5e9c95f	19149464	SIG
macOS 64-bit Intel-only installer	macOS	for macOS 10.9 and later, deprecated	7b836e75ebb1dbc8bdae60717fc197d1	30058388	SIG
macOS 64-bit universal2 installer	macOS	for macOS 10.9 and later	ab312c51dfb44108d1936342f53803c1	38167074	SIG
Windows embeddable package (32-bit)	Windows		719dc57d39fb22a1289487a5f8ba1da0	7661191	SIG
Windows embeddable package (64-bit)	Windows		2cb98470ee86603d893e518613fdb76a	8472039	SIG
Windows help file	Windows		92d8ab8da1b95824bf05a340cdfd2bde	9279391	SIG
Windows installer (32-bit)	Windows		090291d68b7bbc50a0fe53af6a104bd9	27842600	SIG
Windows installer (64-bit)	Windows	Recommended	8147fa17b727d6ed8b3fbed8fa9b3724	28908176	SIG

Please now run the file and tick the “Add Python 3.9 to PATH” box at the bottom before clicking on “Install Now”.



Once all files were installed, you will receive a “Setup was successful” message. Now please click on “Disable path length limit” and confirm your choice and finally click on the “Close” button at the bottom right.



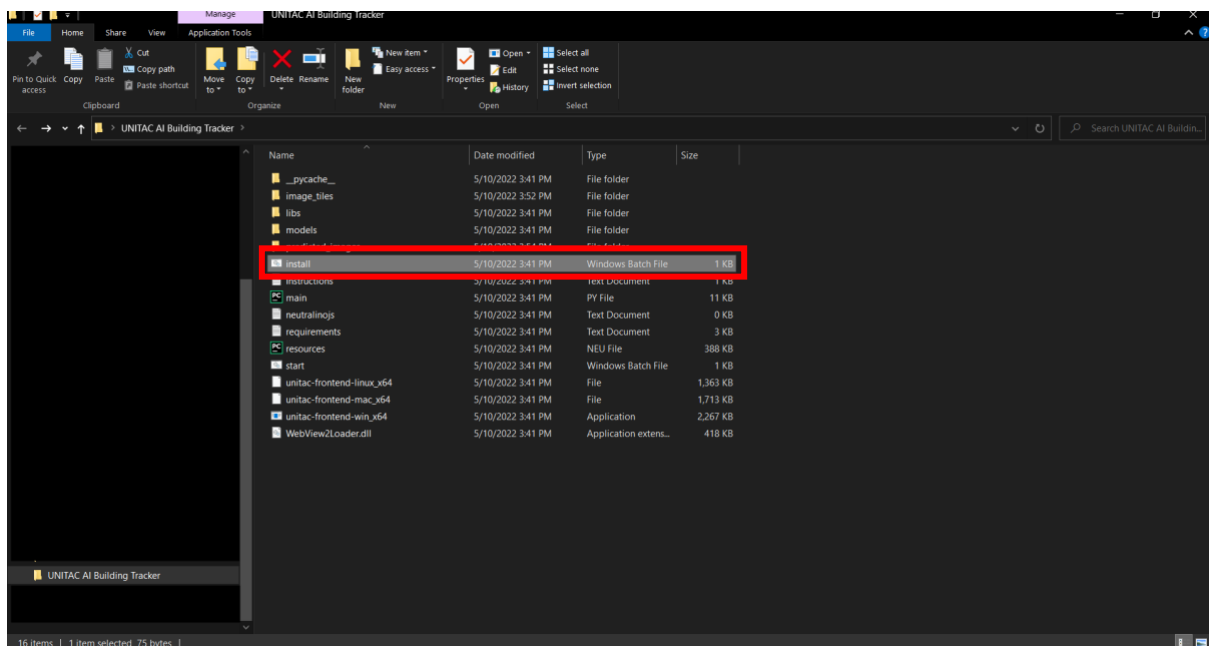
2. Installing the Tool

Before being able to run the tool, the required Python packages also need to be downloaded.

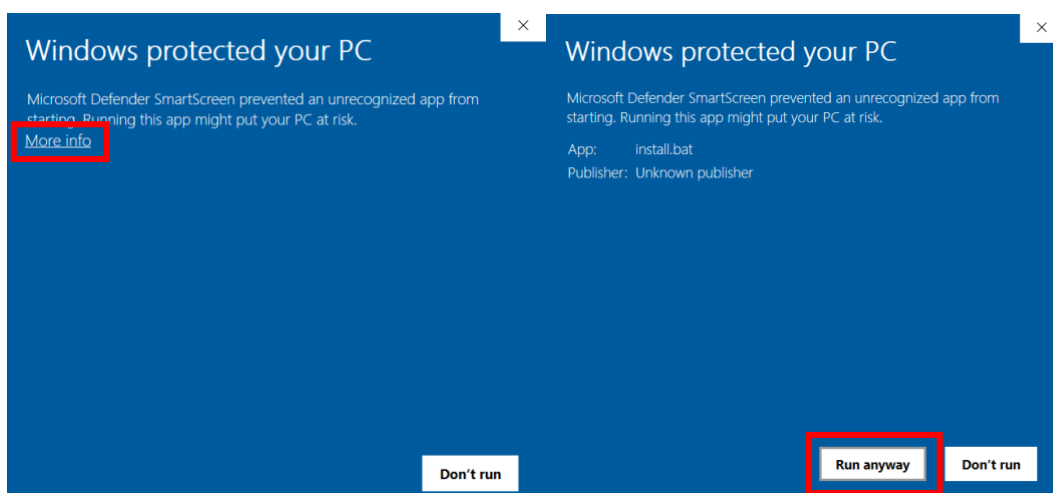
For this, the following three files need to be in the 'libs' folder (should be the case by default):

- Fiona-1.8.21-cp39-cp39-win_amd64.whl
- GDAL-3.4.1-cp39-cp39-win_amd64.whl
- rasterio-1.2.10-cp39-cp39-win_amd64.whl

You can now install all Python packages required to run the tool by double-clicking the “install.bat” file in the tool’s main folder.



Depending on your Operating System’s security settings, you might be shown a security warning for executing the file. Here, you need to click on “More info”. Now, you need to click on “Run anyway” to install the required packages.

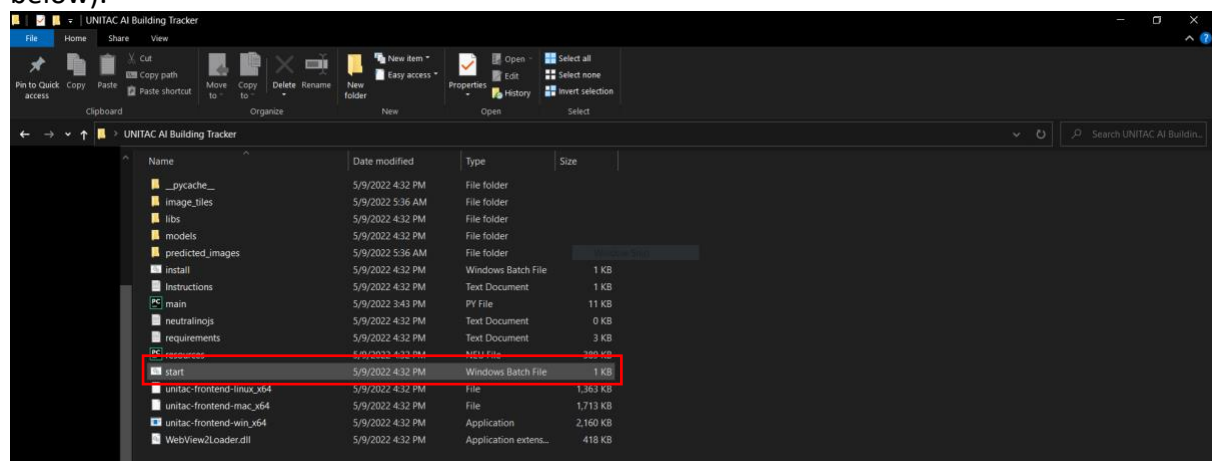


Now, a command line window will open and the packages will be installed. The installation is finished when you see an empty line at the very bottom followed by a line containing the directory that the “install.bat” file is in (the other lines will look different from this screenshot when you are running the file for the very first time). Now you can close the window and proceed.

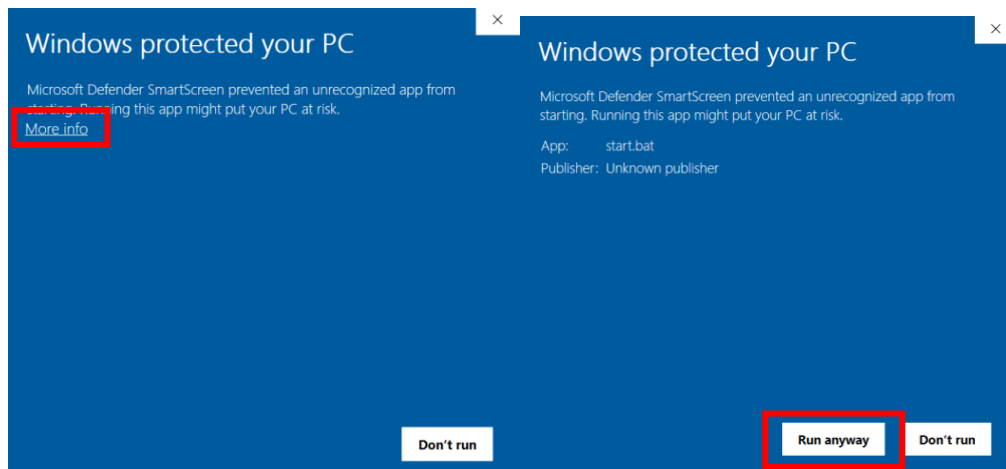
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C:\WINDOWS\system32\cmd.exe
Requirement already satisfied: backcall in c:\users\
Requirement already satisfied: setuptools>=18.5 in c:\users\
Requirement already satisfied: jedi<0.16 in c:\users\
Requirement already satisfied: traitlets>=5 in c:\users\
Requirement already satisfied: matplotlib-inline in c:\users\
Requirement already satisfied: decorator in c:\users\
Requirement already satisfied: colorama in c:\users\
Requirement already satisfied: pyrsing>=2.2.1 in c:\users\
Requirement already satisfied: fonttools>=4.22.0 in c:\users\
Requirement already satisfied: kiwisolver>=1.0.1 in c:\users\
Requirement already satisfied: cycler>=0.10 in c:\users\
Requirement already satisfied: python-dateutil>=2.7 in c:\users\
Requirement already satisfied: parso<0.9.0,>=0.8.0 in c:\users\
Requirement already satisfied: wcwidth in c:\users\
Requirement already satisfied: six>=1.5 in c:\users\
Requirement already satisfied: preshed<3.1.0,>=3.0.2 in c:\users\
Requirement already satisfied: typer<0.5.0,>=0.3.0 in c:\users\
Requirement already satisfied: spacy-loggers<2.0.0,>=1.0.0 in c:\users\
Requirement already satisfied: blis<0.9.0,>=0.4.0 in c:\users\
Requirement already satisfied: jinja2 in c:\users\
Requirement already satisfied: pathy<0.3.5 in c:\users\
Requirement already satisfied: langcodes<4.0.0,>=3.2.0 in c:\users\
Requirement already satisfied: murmurhash<1.1.0,>=0.28.0 in c:\users\
Requirement already satisfied: spacy-lazycy<1.1.0,>=3.0.8 in c:\users\
Requirement already satisfied: cyemem<2.1.0,>=2.0.2 in c:\users\
Requirement already satisfied: wasabi<1.1.0,>=0.8.1 in c:\users\
Requirement already satisfied: srsly<3.0.0,>=2.4.1 in c:\users\
Requirement already satisfied: thinc<8.1.0,>=8.0.12 in c:\users\
Requirement already satisfied: pydantic<1.8.1,>=1.8.1,<1.9.0,>=1.7.4 in c:\users\
Requirement already satisfied: catalogue<1.0.0,>=2.0.6 in c:\users\
Requirement already satisfied: idna<4,>=2.5 in c:\users\
Requirement already satisfied: charset-normalizer<2.0.0 in c:\users\
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\
Requirement already satisfied: certifi<=2017.4.17 in c:\users\
Requirement already satisfied: typing-extensions in c:\users\
Requirement already satisfied: pytz<=2020.1 in c:\users\
Requirement already satisfied: charset-normalizer<2.0.0 in c:\users\
Requirement already satisfied: threadpoolctl>=2.0.0 in c:\users\
Requirement already satisfied: asttokens in c:\users\
Requirement already satisfied: executing in c:\users\
Requirement already satisfied: pure-eval in c:\users\
Requirement already satisfied: smart-open<6.0.0,>=5.0.0 in c:\users\
Requirement already satisfied: click<9.0.0,>=7.1.1 in c:\users\
\anodata\local\programs\python\python39\lib\site-packages (from ipython->semtorch) (0.2.0)
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\appdata\local\programs\python\python39\lib\site-packages (from prompt-toolkit<3.0.0,>=3.0.1,<3.1.0,>=2.0.0->ipython->semtorch) (0.2.5)
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\appdata\local\programs\python\python39\lib\site-packages (from spacy<4->fastai<3.0.0,>=2.0.0->semtorch) (0.0.13)
\appdata\local\programs\python\python39\lib\site-packages (from spacy<4->fastai<3.0.0,>=2.0.0->semtorch) (1.8.2)
\appdata\local\programs\python\python39\lib\site-packages (from spacy<4->fastai<3.0.0,>=2.0.0->semtorch) (2.0.6)
\appdata\local\programs\python\python39\lib\site-packages (from requests->fastai<3.0.0,>=2.0.0->semtorch) (3.3)
\appdata\local\programs\python\python39\lib\site-packages (from requests->fastai<3.0.0,>=2.0.0->semtorch) (2.0.12)
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\appdata\local\programs\python\python39\lib\site-packages (from torch<1.11,>=1.7.0->fastai<3.0.0,>=2.0.0->semtorch) (4.1.1)
\appdata\local\programs\python\python39\lib\site-packages (from pandas->fastai<3.0.0,>=2.0.0->semtorch) (2021.3)
\appdata\local\programs\python\python39\lib\site-packages (from scikit-learn->fastai<3.0.0,>=2.0.0->semtorch) (4.1.0)
\appdata\local\programs\python\python39\lib\site-packages (from scikit-learn->fastai<3.0.0,>=2.0.0->semtorch) (3.1.0)
\appdata\local\programs\python\python39\lib\site-packages (from stack-data->ipython->semtorch) (2.0.3)
\appdata\local\programs\python\python39\lib\site-packages (from stack-data->ipython->semtorch) (0.8.3)
\appdata\local\programs\python\python39\lib\site-packages (from stack-data->ipython->semtorch) (0.2.2)
\appdata\local\programs\python\python39\lib\site-packages (from pathy>=0.3.5->spacy<4->fastai<3.0.0,>=2.0.0->semtorch) (5.2.1)
\appdata\local\programs\python\python39\lib\site-packages (from typer<0.5.0,>=0.3.0->spacy<4->fastai<3.0.0,>=2.0.0->semtorch) (0.8.4)
\appdata\local\programs\python\python39\lib\site-packages (from jinja2->spacy<4->fastai<3.0.0,>=2.0.0->semtorch) (2.1.0)
C:\Users\
\Desktop\UNITAC AI Building Tracker\
```

3. Opening the Tool

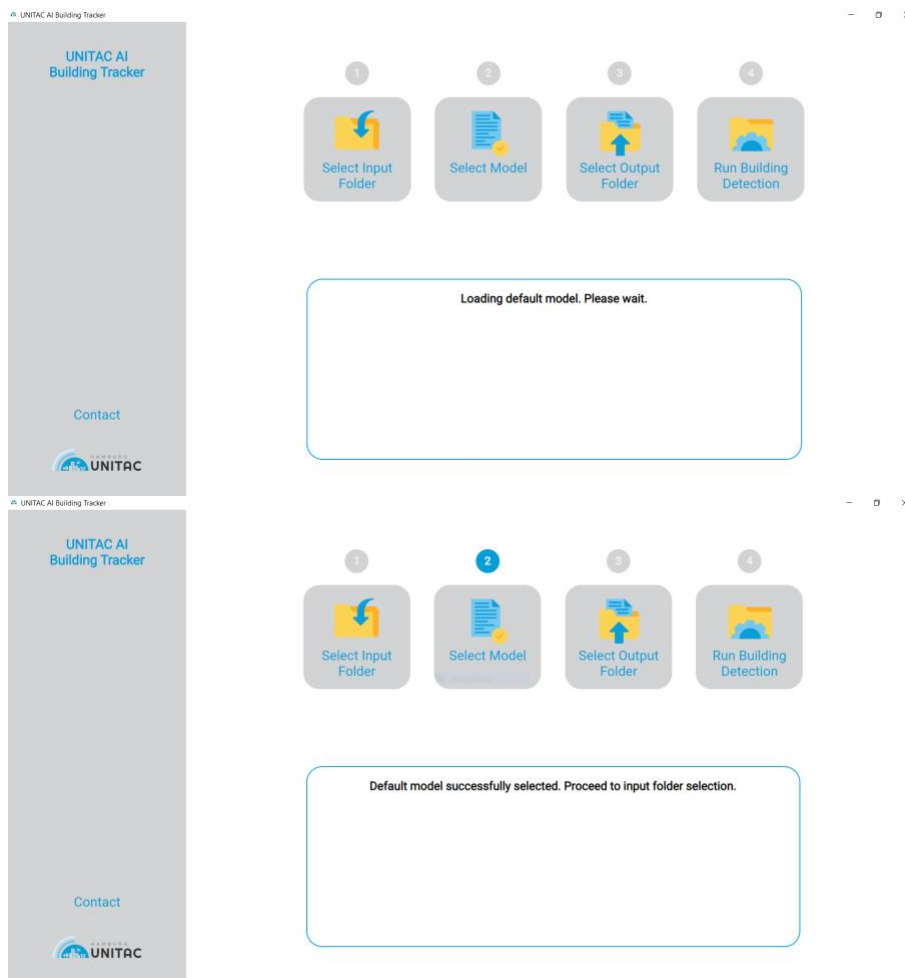
To open the tool, double-click the “start.bat” file in the tool’s main folder (marked in red below).



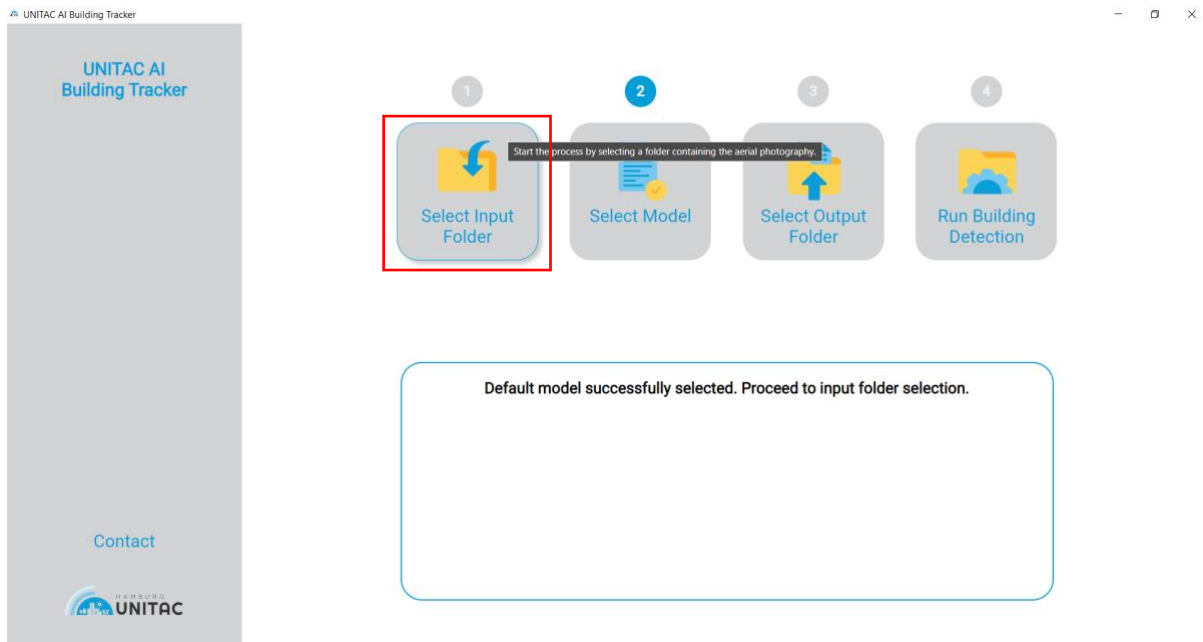
Depending on your security settings, you will again be shown a security warning for executing the file. Here, you need to click on “More info” and then on “Run anyway” to start the tool. These steps will only be required once.



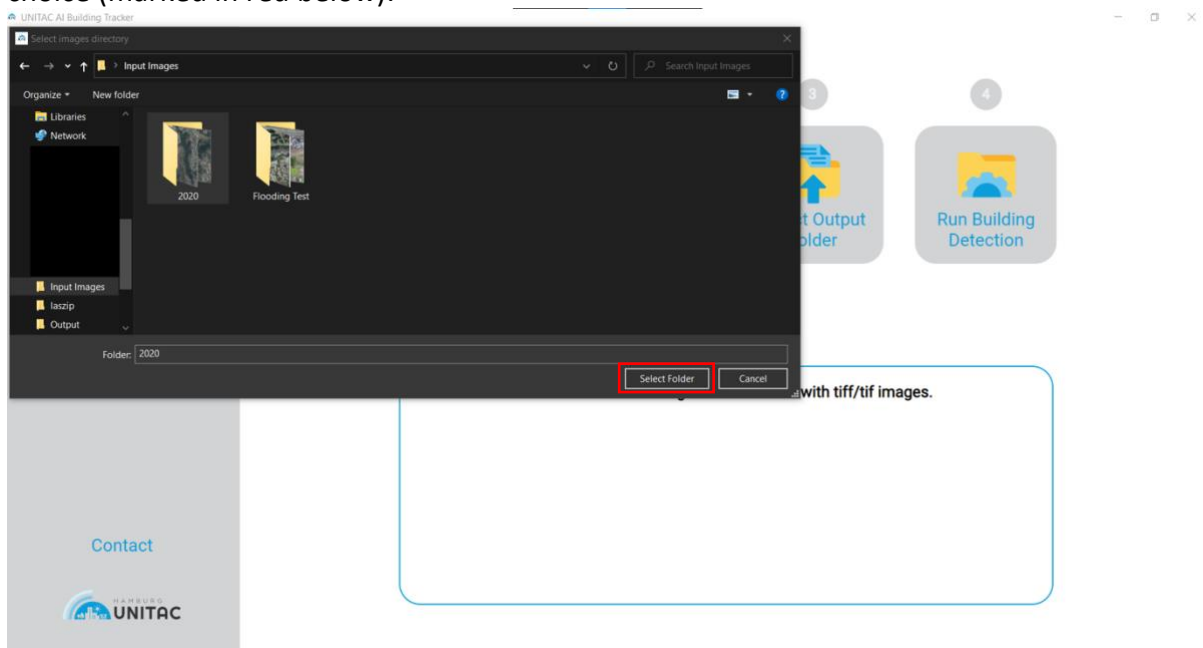
This will open a command line window, which you can ignore, and the main screen of the tool itself. Now you need to wait for After a few seconds, the default model (HRNet) will have been loaded and you can proceed with the next step.



4. Select Input Folder

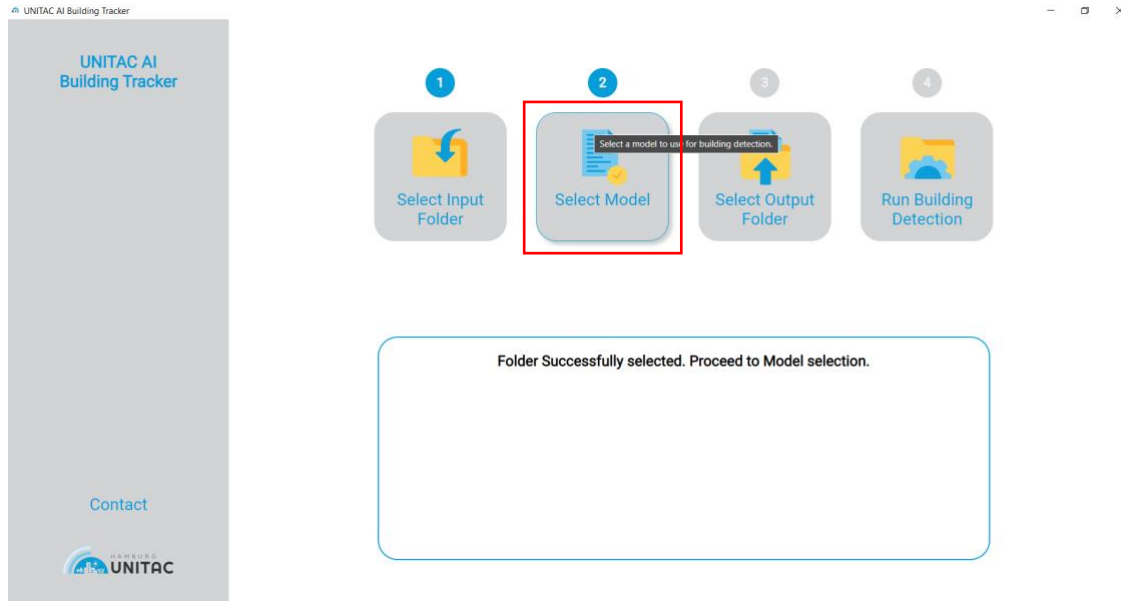


You now have to click on the “Select Input Folder” button (step 1), after which a Windows Explorer window will open. Here you need to navigate to the folder that contains the images you would like the tool to detect buildings in and click on “Select Folder” to confirm your choice (marked in red below).

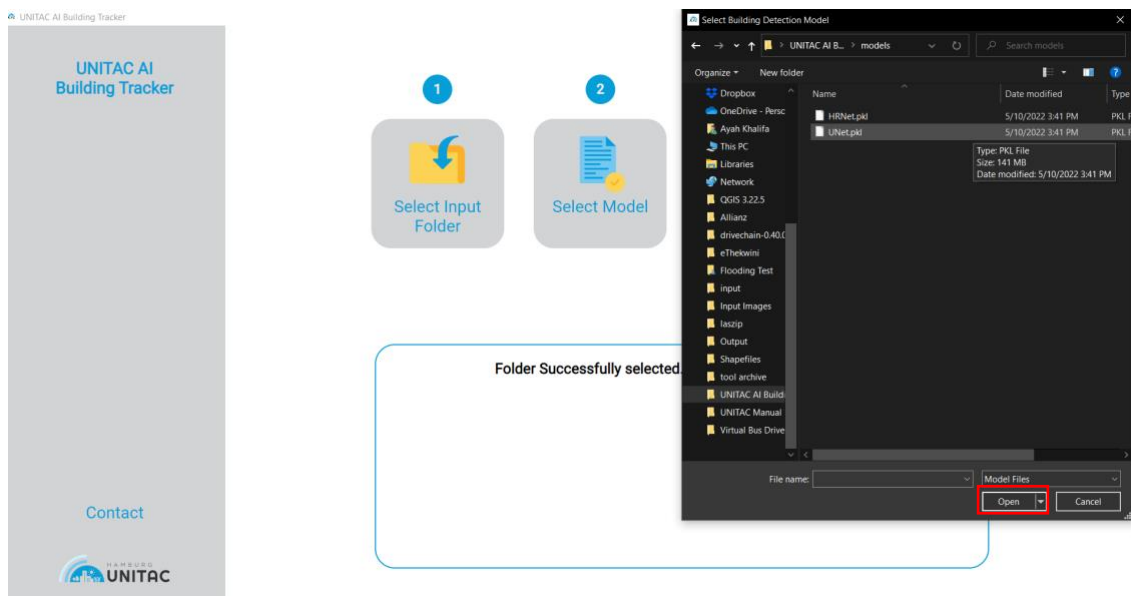


5. (Optional) Select Detection Model

If you do not want to use the model that is loaded by default when the tool is started, you can click on the “Select Model” button.

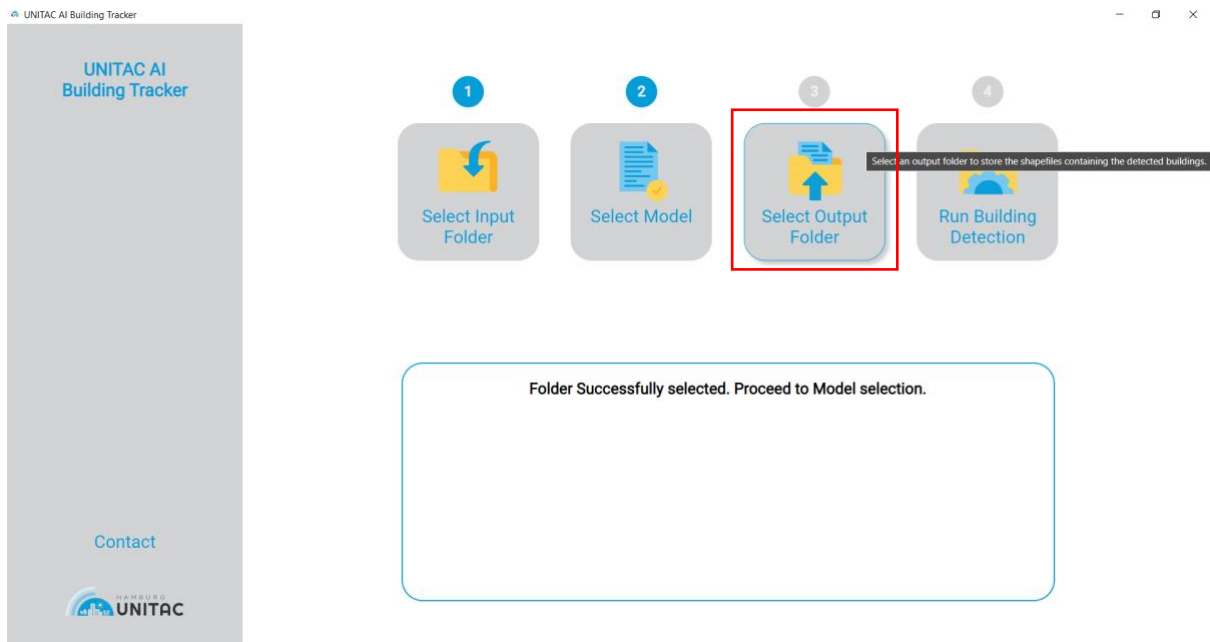


In the tool’s main folder, you will find a folder called “models”, in which the default HRNet and the optional U-Net model are available in the .pkl-file format for your selection, which you can confirm by either double-clicking on it or clicking the “Open” button.

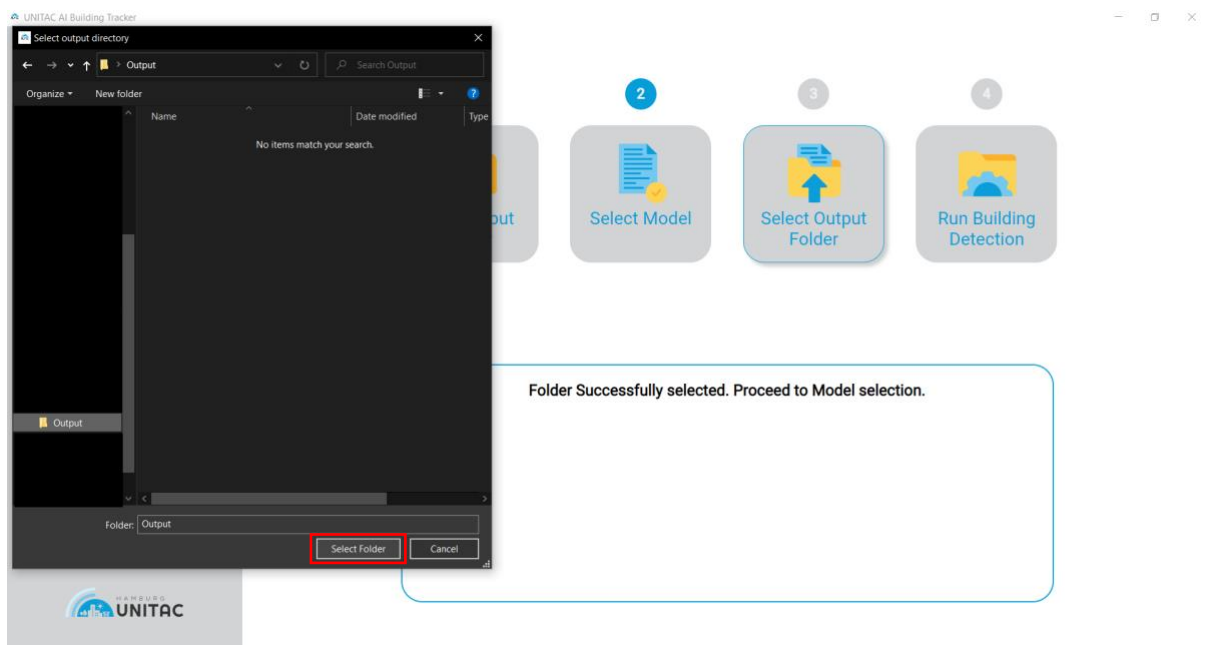


6. Select Output Folder

In the next step, you need to select the folder that the shapefiles containing the detected buildings will be stored in by clicking on the “Select Output Folder” button.

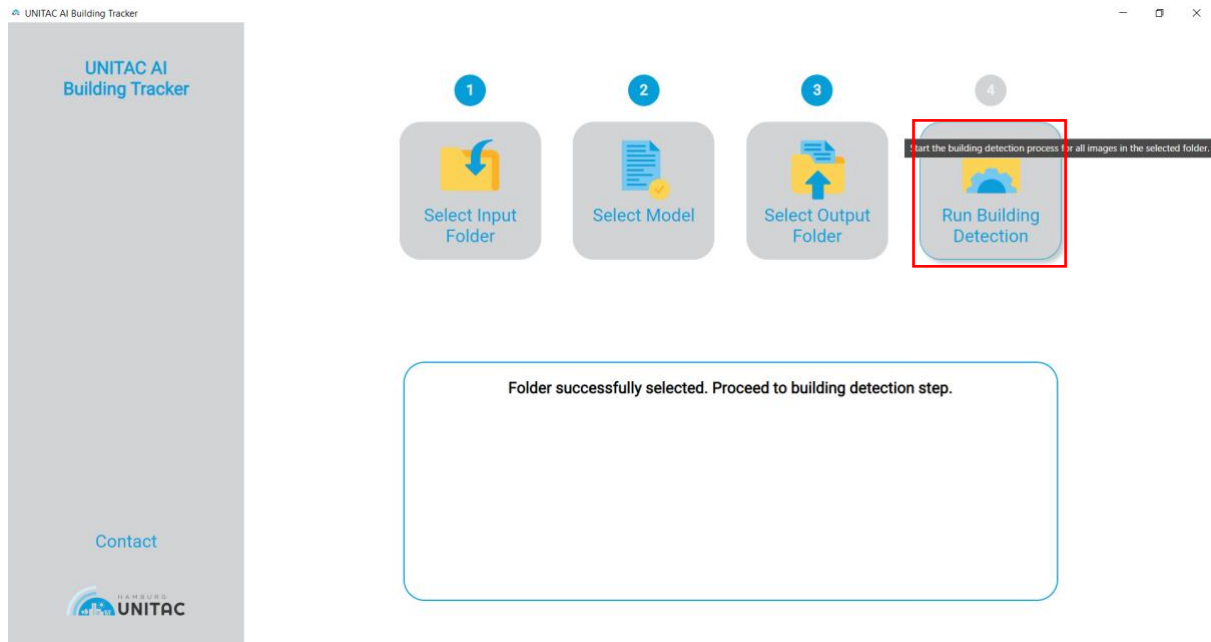


Here you need to select the appropriate folder in the windows explorer windows and confirm your choice by clicking the “Select Folder” button (marked in red below).

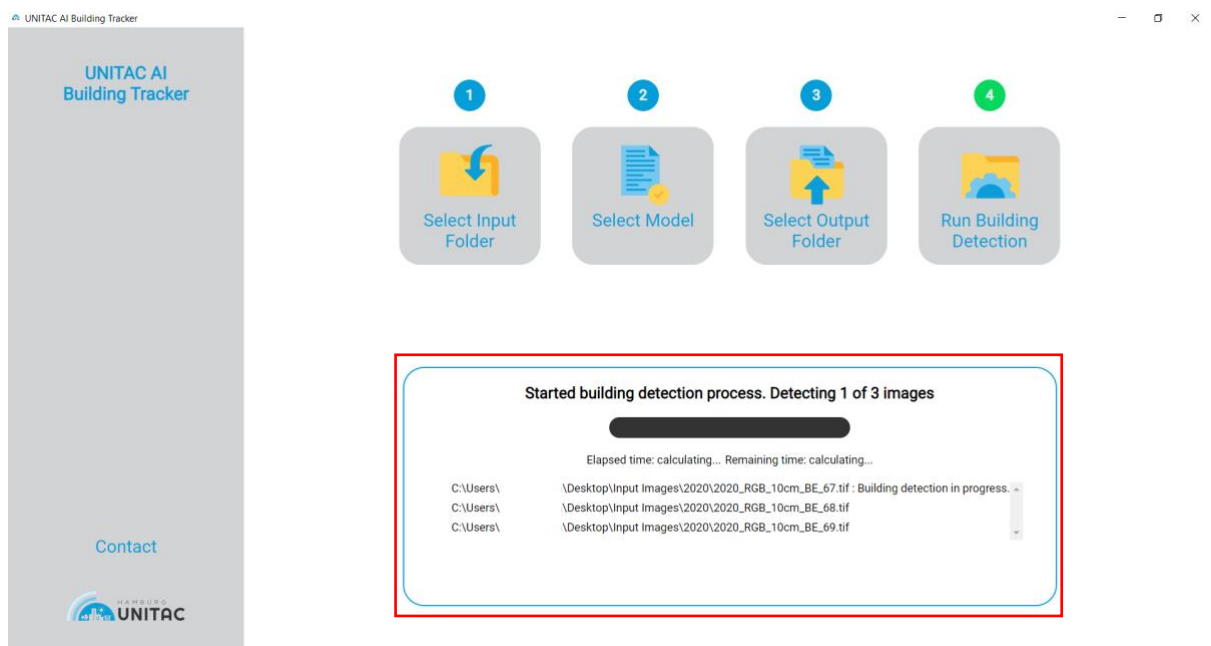


7. Run Building Detection

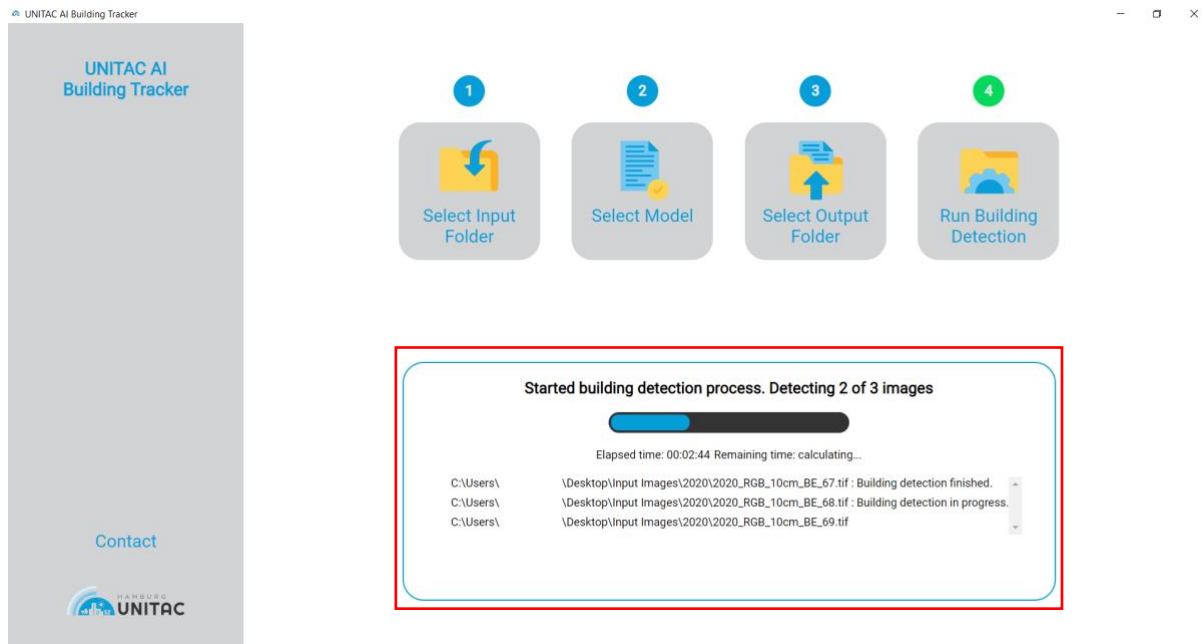
Once all these steps were executed, you will see the message “Folder successfully selected. Proceed to building detection process”, which means you can now click on the fourth and last button (marked in red below) to start the detection process.



You will now see the progress of the building detection in the status window marked in red below.



The status window will be updated with the current progress of the detection process. Once the status message for an image changes to “Building detection finished.”, you can start working with the shapefile in the output folder (see step 7).



Once the building detection is completed, you will be notified in the status window.



8. Retrieving Shapefiles

You can now close the tool and accompanying command line window and navigate to the output folder that you chose previously. There, you will find five different files per image in the input folder. By double-clicking on the .shp file, you can now view the detected building layers in the GIS-tool of your choice.

