

## BEAM (Building & Establishment Automated Mapper) USER MANUAL

UNITAC Hamburg Version 11.2022





### BEAM (Building & Establishment Automated Mapper)

#### **USER MANUAL**

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.

#### **Installing Prerequisites**

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

#### 1. CUDA

While the tool can run 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 <u>here</u> (and then under "CUDA-Enabled Geforce and TITAN Products").

Please keep in mind that you should have at least 8 GB of VRAM to run the tool at an agreeable speed.

Two recommended GPUs are:

- <u>NVIDIA GeForce RTX 3060 12 GB RAM</u> Compute Score 8.6
- NVIDIA GeForce RTX 2060 12 GB RAM Compute Score 7.5

Download CUDA 11.3.0, which was tested with the tool, here: <u>https://developer.nvidia.com/cuda-11.3.0-download-archive</u> (an alternative download link from the HafenCity University cloud can be found here: <u>https://cloud.hcu-hamburg.de/nextcloud/s/rqHCYzx7zafP93q</u>).

On the CUDA website, select Windows as your Operating System, x68\_64 as the architecture, Version 10, and exe (local) as the Installer type. Then, press 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 fu terms and conditions of the CUDA EULA.	lly comply with the
Operating System Linex 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 Dow	nload (2.7 GB) 🕹
Installation Instructions:	cuda_11.3.0_46
1. Double click cuda_11.3.0_465.89_win10.exe	

Run the 2.7 large installation file named "cuda\_11.3.0\_456.89\_win10.exe" after its download is completed. Confirm the default folder chosen to extract the installer files by clicking on "OK".

CUDA Setup Pack	kage X
Please ent the NVIDI it will be co	er the folder where you want to temporarily extract A CUDA Toolkit installer. If the folder does not exist, reated for you.
Extraction path:	
C:\Users\	\AppData\Local\Temp\CUDA
[	OK Cancel
NVIDIA Installer	x
NVIDIA CUDA Version 11.3	
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License Agreement	Please read the following NVIDIA software license agreement carefully.
Options	NVIDIA Corporation
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Finish	IMPORTANT - READ BEFORE COPYING, INSTALLING OR USING Do not use or load any of the software and any associated materials provided by NVIDIA on this extranet site (collectively, the "Software") until you have carefully read the following terms and conditions. By loading or using the Software, You agree to
	Click Agree and Continue if you accept the terms of the agreement.

Next, except the license agreement by clicking on the green" AGREE AND CONTINUE" button.

You can keep the default installation option "EXPRESS RECOMMENDED" to confirm by clicking the green "NEXT" button



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 the window about "Nsight Visual Studio edition summary", pops up, also click the green "NEXT" button. CUDA will be now installed.



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

System Check     NVIDIA Installer has finished       License Agreement        Options     Component       Version     Status       CUBLAS Development     11.3       CUBLAS Development     11.3       Install     CuFFT Development       Finish     Demo Sute					
Options         Component         Version         Status           Install         CUBLAS Development         11.3         Installed           CUFFT Development         11.3         Installed           Finish         Occupancy Calculator         11.3         Installed           Demo Suite         11.3         Installed		hed	has finis	NVIDIA Installer	<ul> <li>System Check</li> <li>License Agreement</li> </ul>
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#### 2. Python

Important Notes before the installation:

If you already have Python installed on your device, you should <u>uninstall it</u> (Like any other Windows Program) and delete the cache. To do so, you must delete the pip folder and the files python.exe and python3.exe from the routes below.

- Disk\_Name]\Users\[User\_Name]\AppData\Local\pip
- Disk\_Name]\Users\[User\_Name]\AppData\Local\Microsoft\WindowsApps\Microsoft.DesktopAppInstaller\_8weky b3d8bbwe\

#### Installation

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

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

Run the file and tick the "add Python 3.9 to PATH" box at the bottom before clicking on "Install Now".

Python 3.9.8 (64-bit) Setup	Install Python 3.9.8 (64-bit) Select Install Now to install Python with default settings, or che Customize to enable or disable features.	oose	×
2	→ Install Now C:\Users\ \AppData\Local\Programs\Python\Python3 Includes IDLE, pip and documentation Creates shortcuts and file associations	9	
	→ Customize installation Choose location and features		
python windows	Install launcher for all users (recommended) Add Python 3.9 to PATH	Ca	ancel

Once all files are installed, you will receive a "Set up was successful" message. Click on "Disable path length limit" and confirm your choice and then click on the "Close" button at the bottom right



#### 3. Installing the Tool

Before performing the tool installation, it is essential to restart the device so that your environment path UNITAC Hamburg

#### variable is mapped.

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 "install.bat" in the main folder.



depending on your operating system's security settings, you might be showing 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.

Windows protected your PC	Windows protected your PC
Microsoft Defender SmartScreen prevented an unrecognized app from startinn. Running this app might put your PC at risk. <u>More info</u>	Microsoft Defender SmartScreen prevented an unrecognized app from starting. Running this app might put your PC at risk. App: install.bat Publisher: Unknown publisher
Don't run	Run anyway Don't run

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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Requirement already satisfied: backcall in c:\users\			Ä
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Requirement already satisfied: jedi>-0.16 in c:\users\ \appdata\local\programs\python\python39\lib\site-packages (from ipython->semtorch) (0.18.1)			
Requirement already satisfied: traitlets>=5 in c:\users\ \appdata\local\programs\python\python39\lib\site-packages (from ipython->semtorch) (5.1.1)			
Requirement already satisfied: matplotlib-inline in c:\users\ \appdata\local\programs\python\python39\lib\site-packages (from ipython->semtorch) (0.1.3)			
Requirement already satisfied: pygments>=2.4.0 in c:\users\ \appdata\local\programs\python}9\lib\site-packages (from ipython>semtorch) (2.11.2)			
Requirement already satisfied; decorator in c:\users\ \appdata\local\programs\python\python39\lib\site-packages (from ipython->semtorch) (5.1.1)			
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Requirement already satisfied: typing-extensions in c:\users\ \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)			
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2) Utener () ADeckton (UNITAC AT Building Tanckens			
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#### 4. Opening the Tool

To open the tool, navigate to the folder "unitac-frontend-browser" double-click "start-interface-browser.bat" file in the tool's main folder (market in red below).



Network

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 "Run anyway" to start the tool. These steps will be only required once.

Windows protected your PC	× Windows protected your PC
Microsoft Defender SmartScreen prevented an unrecognized app from the final final his app might put your PC at risk.	Microsoft Defender SmartScreen prevented an unrecognized app from starting. Running this app might put your PC at risk. App: start.bat Publisher: Unknown publisher
Don't run	Run anyway Don't run

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.



#### 5. Select Input Folder



Now, click on the "Select Input Folder" (step 1) after which a Windows Explorer window will pop up. Here, you need to navigate the folder containing the images you would like to the tool to detect buildings and add click on select folder to confirm your choice (market in red below)

#### 6. (Optional) Select Detection Model

If you don't 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 tools 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 though "Open" button.

#### 7. 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 "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).



#### 8. Run Building Detection

■ UNITAC AI Building Tracker x +     ← ⑦ ◎ localhost.57003					- * \$a \$\$ @e	· · · ·
Building & Establishment Automated Mapper	1 Select Input Folder	2 Select Model	3 Select Output Folder	Run Building Detection	- 19 - <sup>1</sup>	
Contact	Folder suc	ccessfully selected. Proc	eed to building detecti	on step.		

Once all the steps are executed, you will see the message "Folders successfully selected. Proceeded to building detection process" which means you can now click on the 4th lost 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 now working with the shape files in the output folder (see step 7).



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



#### 9. 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.

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	2020_RGB_10cm_BE_67.tif_predicted.prj	5/10/2022 3:55 PM	PRJ File 1 KB	
	Q 2020_RGB_10cm_BE_67.tif_predicted	5/10/2022 3:55 PM	SHP File 3,617 KB	
	2020_RGB_10cm_BE_67.tif_predicted.shx	5/10/2022 3:55 PM	SHX File 10 KB	
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5 items				1



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