Ambrosinus Toolkit
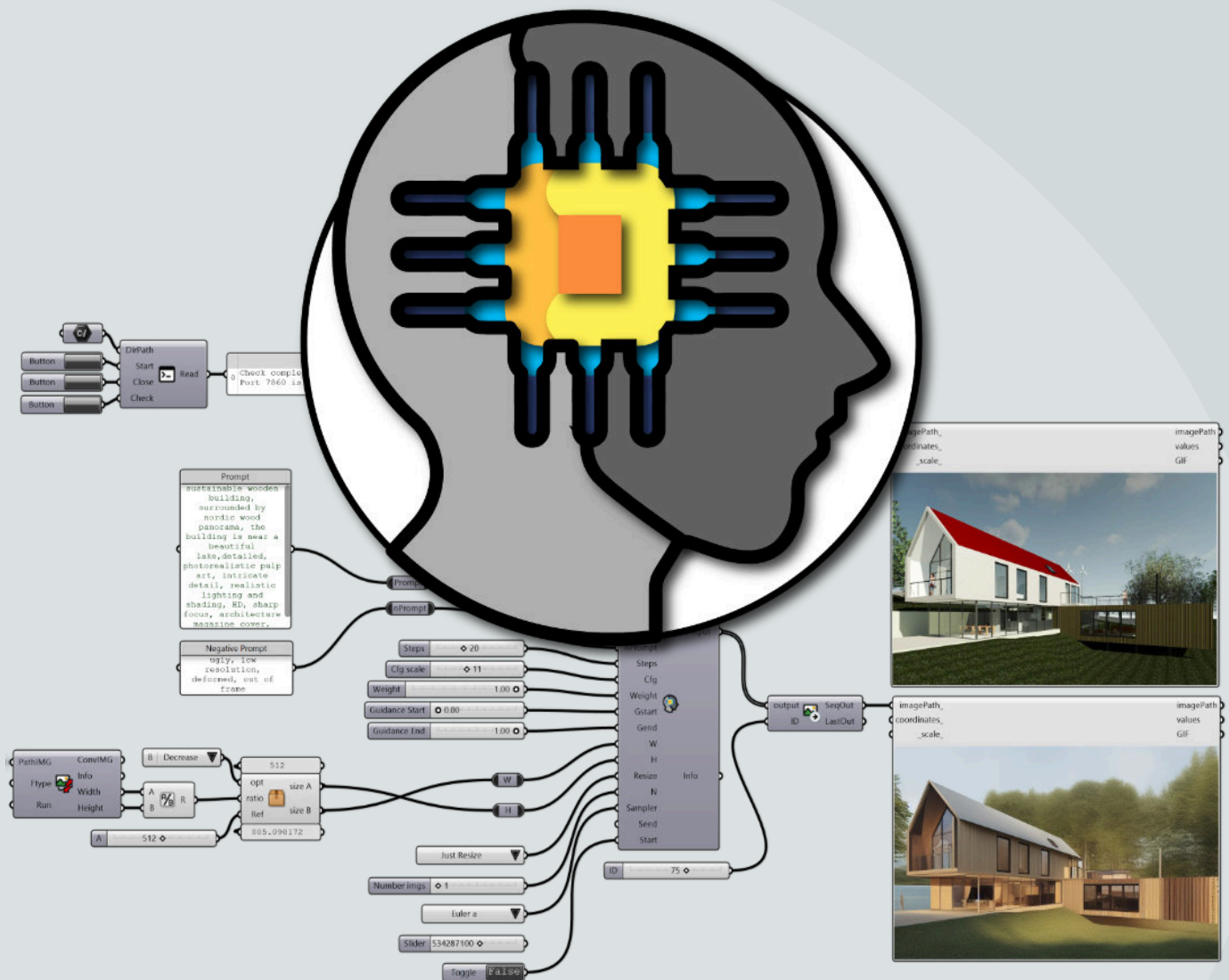
v1.2.9

A **Grasshopper plugin** with a subcategory dedicated to **AI and Stable Diffusion (project A1111)**

Requirements - Installation User Guide

by Luciano Ambrosini

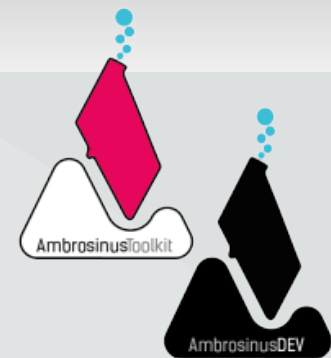# General info

Ambrosinus Toolkit latest v1.2.9

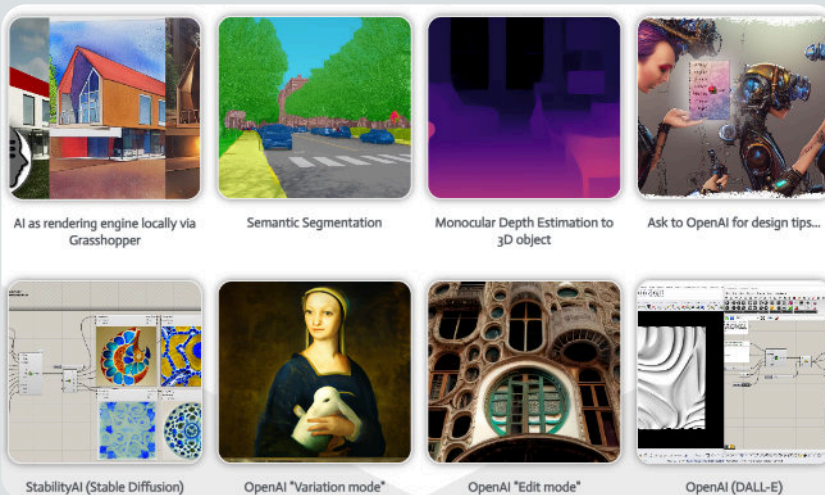*Main development and most tested on:*

Rhino v7 SR37

Grasshopper v7.35.23346.11001

It also runs on Rhino v8

[Read the Changelog](#) of the latest version (May 2024)

Please intend this project as a Work in Progress

AI as rendering engine locally via Grasshopper

Semantic Segmentation

Monocular Depth Estimation to 3D object

Ask to OpenAI for design tips...

StabilityAI (Stable Diffusion)

OpenAI "Variation mode"

OpenAI "Edit mode"

OpenAI (DALL-E)

You can find a full description of all components on my [GitHub Wiki page](#) and on this [Research page](#).

Keep in contact!
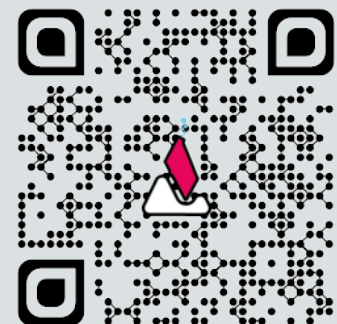
About the Author (Brief)

Luciano Ambrosini is an architect, researcher, and innovator at the intersection of technology and design. With a Master's in Architecture (cum laude) and a PhD in Sustainable Technologies from the University of Naples "Federico II", his academic path started in aerospace engineering before shifting to architecture. His career spans roles as R&D manager at i-Mesh Architextile, environmental design analyst at Foster & Partners, and consultant for the design of Apple Developer Academy. Ambrosini specializes in computational design, environmental analysis and AI integration in architecture, developing cutting-edge tools like an AI toolkit for Grasshopper VPL. As an independent researcher and frequent lecturer at institutions recently at Politecnico di Milano and Georgia Tech, OneWorks etc. he pushes the boundaries of data-driven design in the AEC industry. With scientific publications and coded projects to his name, Ambrosini continues to pioneer innovative approaches that enhance architectural design through advanced technologies and collaborative workflows.

Foreword

Ambrosinus Toolkit (Atk) Overview
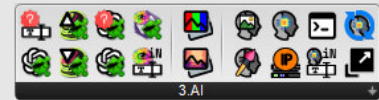
As an architect and computational designer, I've always been drawn to the bleeding edge where creativity, technology, and cultural evolution intersect. The Ambrosinus Toolkit (ATk) for Grasshopper is not just a product of this fascination, but a bold step into uncharted territory—a pioneering experiment in bridging the gap between parametric design and the rapidly advancing world of AI-generated imagery and text.

Throughout my career, I've witnessed the transformative power of computational design in architecture. However, I've also recognized a growing need to push beyond the boundaries of traditional parametric modeling. As AI and machine learning technologies began to revolutionize various fields, I saw an unprecedented opportunity to redefine the very nature of architectural conceptualization and representation.

All these AI-powered tools represent a paradigm shift in our approach to design. **By integrating Stable Diffusion (SD), Open AI, and Stability AI technologies with Grasshopper, we're not just enhancing a workflow—we're opening a portal to a new dimension of creative possibility.** This integration marks ATk as the first experiment of its kind ([read more here](#)), placing the immense potential of AI-generated imagery and, crucially, Large Text Generative Models (LTGMs) directly into the hands of architects and designers within their familiar Grasshopper environment.

I was particularly surprised by **the vibrant community that has formed around it**. This toolkit is as much a product of collective imagination and shared knowledge as it is of individual effort. I am profoundly grateful and continually inspired by all the supporters, users, architects and designers who have demonstrated interest in ATk and shared fundamental feedback on how to implement and improve it. Your insights, questions, and creative applications of the toolkit have been invaluable in shaping its evolution.

It's important to note that ATk is still very much a work in progress. While many tools have been born or will be developed in this exciting new space, ATk remains the first attempt to integrate LTGMs into Grasshopper since their explosion onto the AEC scene.

It's crucial to understand the context in which ATk has been developed. **I've chosen to develop it primarily in my spare time, driven by passion rather than commercial interests.** This approach comes with its own set of challenges – I frequently need to monitor any updates on the Stable Diffusion side that might affect the operation of certain components, ensuring ATk remains functional and up-to-date.

In the broader landscape, there are many powerful and likely more sophisticated projects than ATk that require purchase. **The introduction of the A1111 project was a game-changer in this regard, democratizing access to these technologies**. Similarly, well-defined projects like ComfyUI that build upon A1111 are incredibly valuable in their own right. However, what sets ATk apart is its direct integration with Grasshopper (free of charge) – a feature not offered by these other tools. This integration is what makes ATk unique, bridging the gap between the world of AI-generated imagery and the Grasshopper environment familiar to architects and designers.

Enjoy your design exploration,
Luciano Ambrosini

Machine side

A step by step guideline to install on your PC/laptop (Win) Python and Git module

Since ATk is developed using a hybrid approach with programming languages such as C# (NET framework), Python, and native Grasshopper scripts, users must "prepare" their PC/laptop (Windows) to execute the developed tools correctly.

Step 1

Install the [Python release 3.10.6](#) (this is the version I have tested and currently use – amd64) – It is really important to accept the default settings and tick this option `Add python.exe to PATH` (Fig. 1);
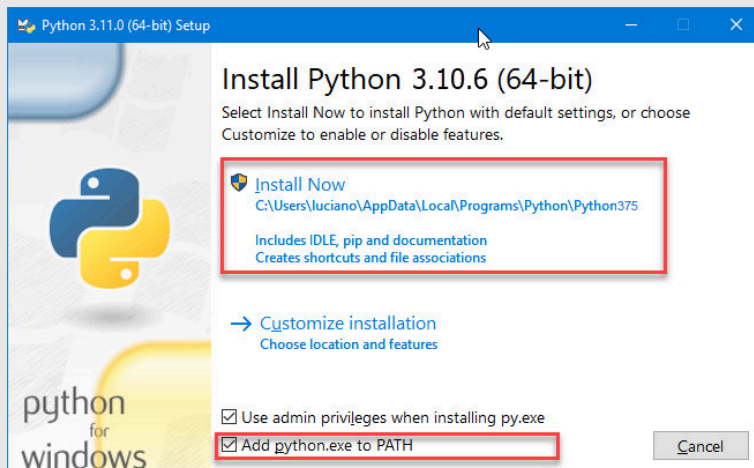
Fig. 1

Step 2

Check your pip installation you should read a list of commands and general options – if it is your case jump to Step 3:

Launch the command prompt window:

Press `Windows Key + X`
Click `Run`
Type in `cmd.exe` and hit enter
In cmd.exe type: `pip help`

Fig. 2

Sometimes some machines **do not have the pip protocol installed** ([full source here](#)).

If you encounter this issue execute these steps:

Launch a command prompt if it isn't already open. To do so, open the Windows search bar, type `cmd` and click on the icon.

Then, run the following command to download the get-pip.py file: `curl https://bootstrap.pypa.io/get-pip.py -o get-pip.py`

Step 3

Install following libraries in order to run **OpenAI**, **StabilityAI** and **Atk** Grasshopper components:

From `cmd.exe` viewport text these commands:

`pip install openai`
Press Enter (wait until done)

`pip install stability-sdk`
Press Enter (wait until done)

So, always from `cmd.exe` viewport launch this command:

`pip install atoolkitdpt`
Press Enter (wait until done)

Step 4

The designer/user is now ready to set up their Windows PC or laptop for the installation of the Stable Diffusion (A1111) project. To do this, it is necessary to download this Git module application (64bit), which enables the cloning of the repository folder where the project is hosted on its official GitHub page.

Stable Diffusion Installation

A step by step guideline to install on your PC/laptop (Win) Stable Diffusion (A1111) project with ControlNet module

Let's move on to installing the core component that allows users to locally execute some of the most significant features offered by the AI for image generation

Step 1

Create an empty folder wherein you want to install Stable Diffusion from the A1111 project, in my case, it was this: `D:\Desktop\SDlocal\`
I suggest to choose a folder located in your HDD that not requires any Administrative privilege.
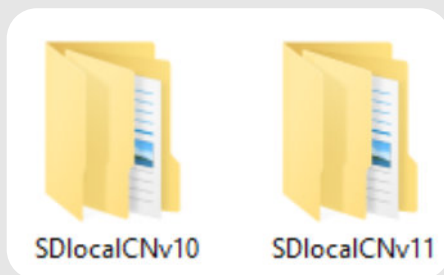
Fig. 1

Step 2

From the above folder (open it before) type this shortcut:
`ALT + F + S + A`
to launch Windows Powershell as Administrator (it is the same if you run CMD.exe as Admin) and type this command to clone the Automatic1111 repository directly in that folder (in my case it is):
`D:\Desktop\SDlocal\stable-diffusion-webui>git clone https://github.com/AUTOMATIC1111/stable-diffusion-webui.git`
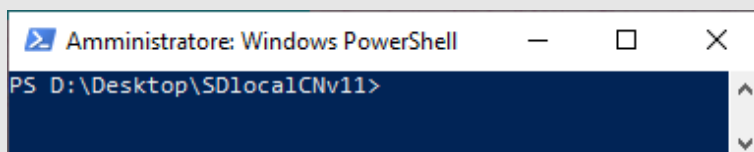
Fig. 2

After the installation you got this:
`D:\Desktop\SDlocalCNv11\stable-diffusion-webui`

Step 3

Run on Windows OS `webui.bat` (or `webui-user.bat`) file in CMD.exe as Administrator credentials. The process could take a while if it is the first run.

If all the process was successful you should see on the screen something similar to the Fig. 3 below (if the commit hash value is "None" something went wrong):

Fig. 3

Step 4

Go to the local URL: `http://127.0.0.1:7860` and from the WebUI *"Extensions tab"* and copy and paste this address directly in the *"Install from URL tab"* specifically inside the text box *"URL for extension's github repository"*:

`https://github.com/Mikubill/sd-webui-controlnet`

Finally, click on *"Install"* and restart UI (you can restart also from the Installed tab).
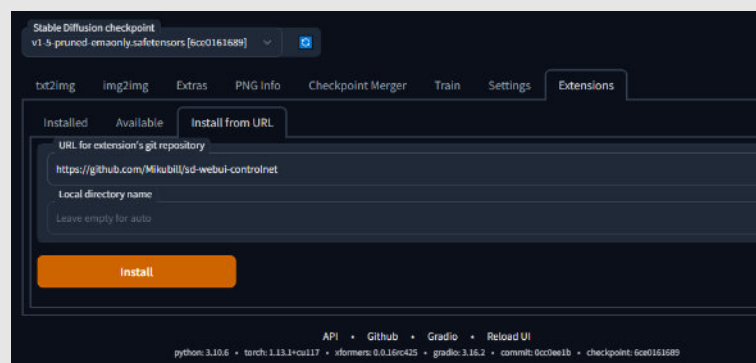
Fig. 4

This will install the **ControlNet v1.X** (the latest one). If you want to install the **ControlNet v1.0** you need copy and paste in the same position above this URL:
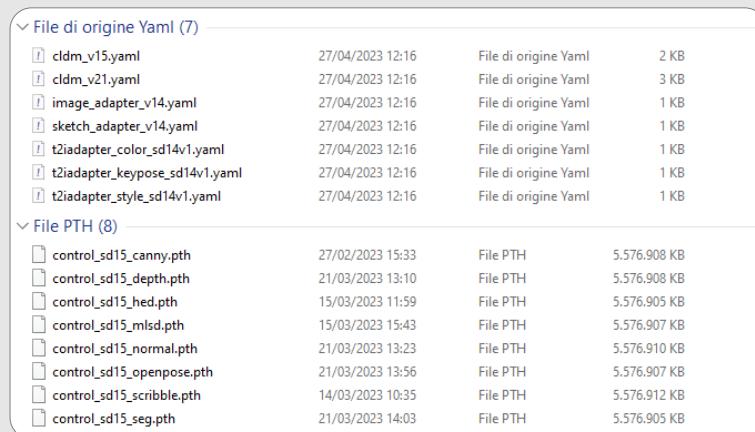
`https://github.com/lllyasviel/webui-controlnet-v1-archived.git`

ControlNet checkpoint models

Download the right CN checkpoint models for v1.0 and/or v1.X (such as canny, mlsd, hed, open pose etc...)

CN v1.0

For manipulating images it is necessary [download these checkpoint models](#) (.pth files ~5GB each one) and place them here:

`D:\Desktop\SDlocalCNv10\stable-diffusion-webui\extensions\webui-controlnet-v1-archived\models`

Fig. 1

CN v1.X

For manipulating images it is necessary [download these checkpoint models](#) (only .pth files ~1.45GB each one) and place them here:

`D:\Desktop\SDlocalCNv11\stable-diffusion-webui\extensions\sd-webui-controlnet\models`

Fig. 2

I generally recommend using CN v1.X (the latest version) because it has nearly full support from SD FastAPI.

Stable Diffusion trained database
Download your preferred trained database, as it determines the quality and style of the final image

Extra info

Here a selction of the most popular trained database for Architecture & Design. The following is merely an example:
-RealisticVisionV51_v51VAE
-Epicrealism_pureEvolutionV5
-Deliberate_v2
-Cyberrealistic_v41
-Mdjrny-v4
-ArchitectureRealMix
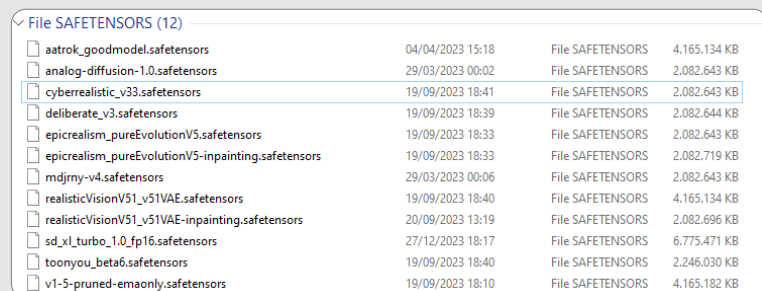
many more have been implemented

This is especially true when using the ATk "Aloutpaint" component, it is important to properly set up a trained database for inpainting.

There are various trained models available, among which the following are the most commonly utilized: UltraSharp, NMKD, SwinIR, etc...

CivitAI Repository

It is the most renowned and comprehensive repository where you can download numerous trained databases at no cost. After selecting the databases that interest you the most, you must download and install them in this folder:

`D:\Desktop\SDlocalCNv11\stable-diffusion-webui\models\Stable-diffusion`

File SAFETENSORS (12)			
aatrok_goodmodel.safetensors	04/04/2023 15:18	File SAFETENSORS	4.165.134 KB
analog-diffusion-1.0.safetensors	29/03/2023 00:02	File SAFETENSORS	2.082.643 KB
cyberrealistic_v33.safetensors	19/09/2023 18:41	File SAFETENSORS	2.082.643 KB
deliberate_v3.safetensors	19/09/2023 18:39	File SAFETENSORS	2.082.644 KB
epicrealism_pureEvolutionV5.safetensors	19/09/2023 18:33	File SAFETENSORS	2.082.643 KB
epicrealism_pureEvolutionV5-inpainting.safetensors	19/09/2023 18:33	File SAFETENSORS	2.082.719 KB
mdjrny-v4.safetensors	29/03/2023 00:06	File SAFETENSORS	2.082.643 KB
realisticVisionV51_v51VAE.safetensors	19/09/2023 18:40	File SAFETENSORS	4.165.134 KB
realisticVisionV51_v51VAE-inpainting.safetensors	20/09/2023 13:19	File SAFETENSORS	2.082.696 KB
sd_xl_turbo_1.0_fp16.safetensors	27/12/2023 18:17	File SAFETENSORS	6.775.471 KB
toonyou_beta6.safetensors	19/09/2023 18:40	File SAFETENSORS	2.246.030 KB
v1-5-pruned-emaonly.safetensors	19/09/2023 18:10	File SAFETENSORS	4.165.182 KB

Fig. 3

About Inpainting...

When utilizing diffusive techniques like **inpainting** or **outpainting**, ensure you first acquire the trained database labeled with "inpainting" and place it inside the aforementioned folder.
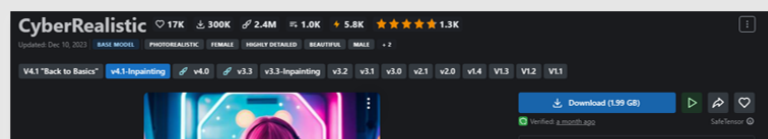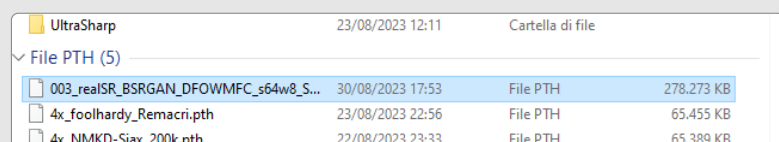

Fig. 4

About Upscaling...

Upscaling is a process that enables the enlargement of an image while minimizing resolution loss. Download and install them in this folder: `D:\Desktop\SDlocalCNv11\stable-diffusion-webui\models\ESRGAN`

UltraSharp	23/08/2023 12:11	Cartella di file	
File PTH (5)			
003_realISR_BSRGAN_DFOWMFC_s64w8_S...	30/08/2023 17:53	File PTH	278.273 KB
4x_foolhardy_Remacri.pth	23/08/2023 22:56	File PTH	65.455 KB
4x_NMKD-Siax_200k.pth	22/08/2023 23:33	File PTH	65.389 KB

Fig. 5

Grasshopper side

Ambrosinus Toolkit Grasshopper installation and Python requirements

Step 1

Download the latest version of ATK directly from [Food4Rhino](#) (Fig. 1) which requires manual installation like all common **.gha files**, or through the **Rhino Package Manager** (Fig. 2) for an automated procedure. The components that become available after installation are all coded in C# (.NET Framework).
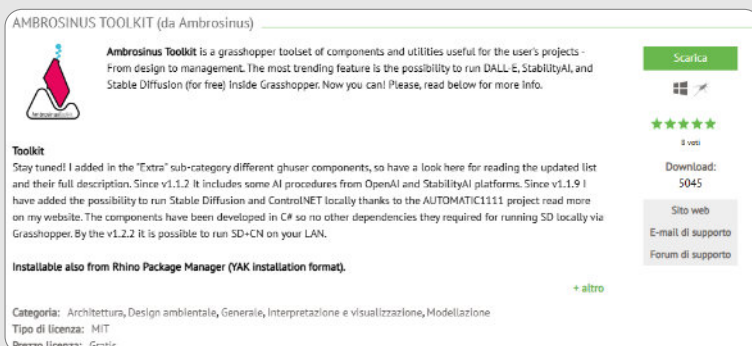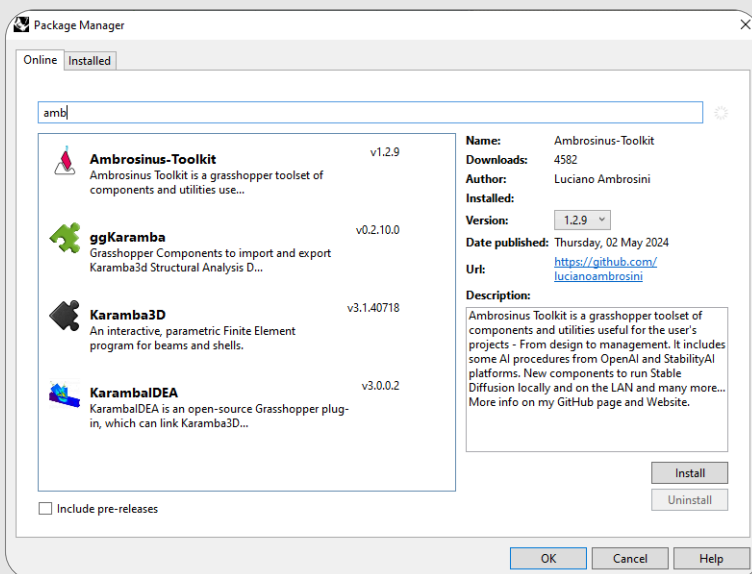
Fig. 1

Fig. 2

If you want to get further info about ATK and in whick languages each compoent has been coded, [please have a look at Dev Atk main page](#)

This page provides the development register (dev log) for all components and tracks the ongoing progress of the plugin's development. Please note that ATK is perpetually a work in progress.

Step 2

To execute certain Atk Python-coded components, it is necessary to [install the GH_CPython Plugin](#) (Fig. 3), ensuring it is "Unblocked" as outlined in Step 1 (it has a black Python icon)
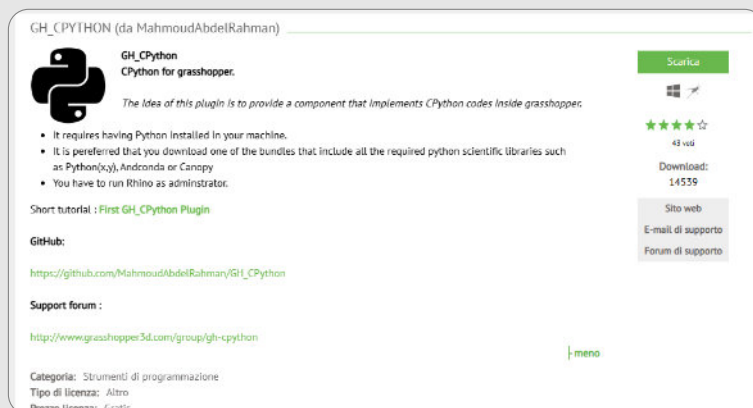
Fig. 3

Step 3

ATk has undergone extensive testing on Rhino V7 and is also compatible with Rhino V8. However, since some components are developed in Python and are external to the initial package installation (**.ghuser** format), they must be downloaded from the GitHub official page:
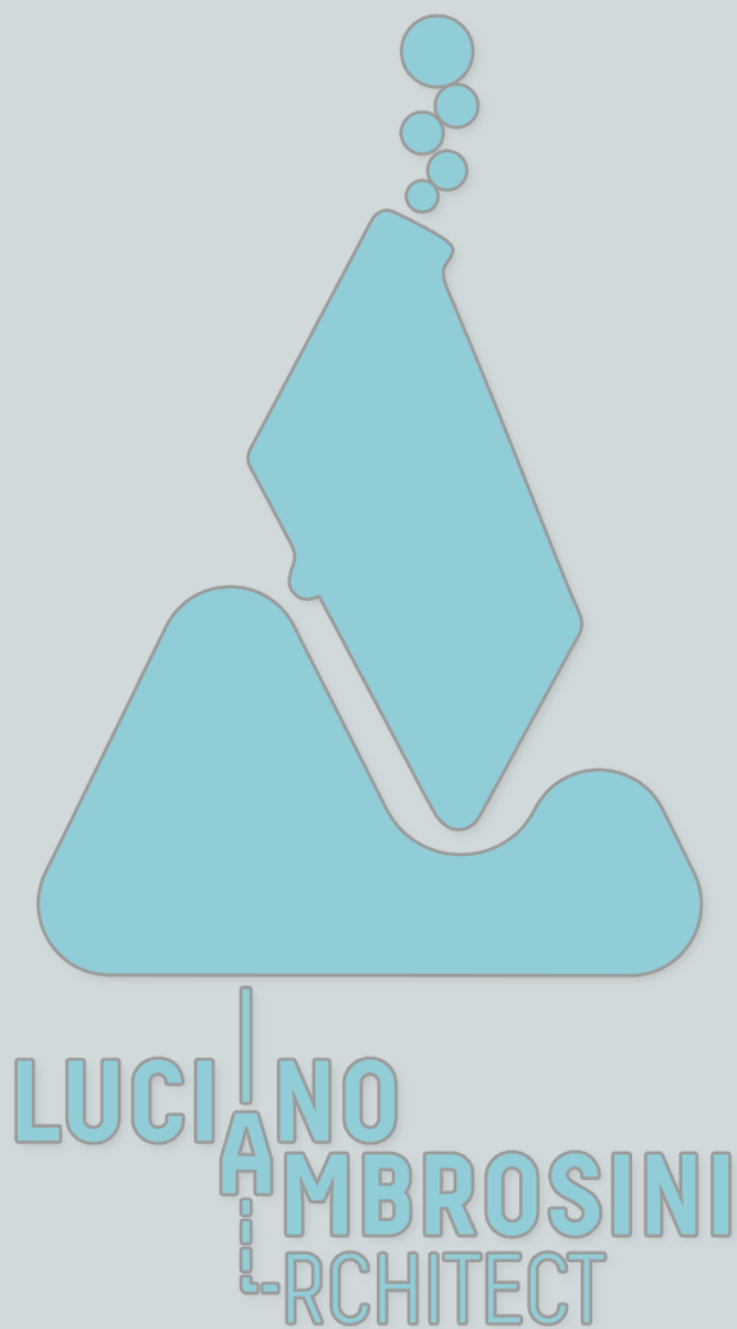
[Extra AI components](#)

[Extra Image components](#)

[Extra components](#) (generally pastime funny)

Step 4

To run components such as **DPTto3D** and **DPTSemSeg**, in addition to installing the Atoolkitdpt library (latest version 0.0.2) as outlined in the "Machine Side" section, **it is essential to download the databases trained by Intel researchers**. The "Weights Model" can be downloaded from the bottom of the [AtoolkitDpt repository's Github page](#).

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