BENTLEY ACADEMIC REALITY MODELING DESIGN COMPETITION : TECHNICAL MANUAL

Bentley's STUDENTserver

What is the STUDENTserver?

STUDENTserver is a self-service one-stop website for students and Faculty to

- Download free software to your personal laptop or home computer
- Take online training (there are 2 types: Lectures=streaming videos; Hands-on=textbook style)
- Review your Transcript (A Transcript is your record of completed courses. The Transcript is useful for augmenting your job applications)
- Connect with other students/staff from around the world through wikis, blogs, etc.

You may find STUDENTserver here: **www.bentley.com/studentserver** **or** **http://apps.bentley.com/studentserver/home/index**

STUDENT SERVER HOME PAGE
https://www.youtube.com/watch?v=36VeSu45EWc&feature

What is my School Code?

Your School Code identifies you as a student of the University. You will use this code for a one-time registration on STUDENTserver.

For your School Code: "Please Contact Event Admin"

Once you have registered on STUDENTserver, you may discard this School Code. To login from now on requires only your login (which is your email) and your password which you chose at the time that you registered.

How do I register (or join) STUDENTserver?

How to register on STUDENTserver may be viewed here:
http://www.youtube.com/watch?v=tnlXgXSBTFw&hd=1

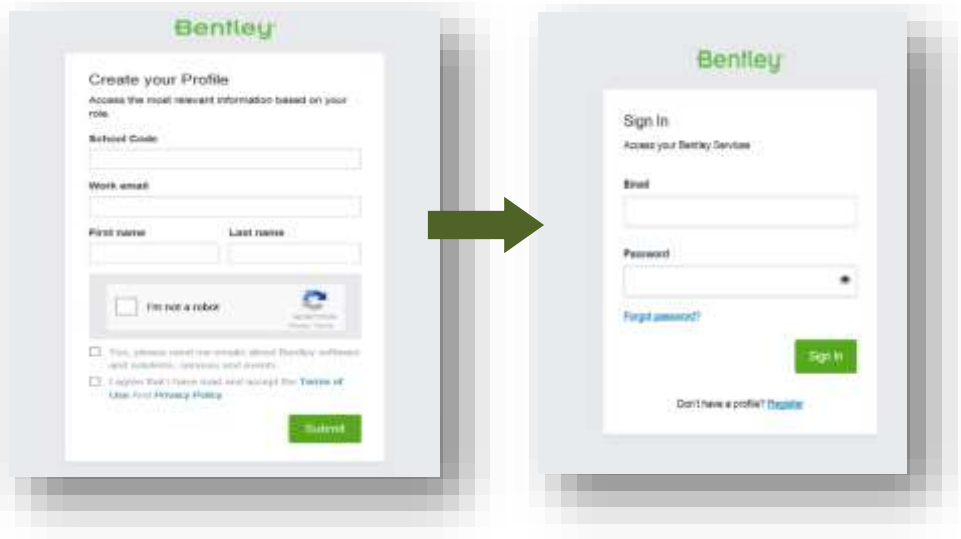
If you do not have access to YouTube, here are the instructions:

1) Go to the STUDENTserver website: **www.bentley.com/studentserver**
2) You will be prompted to register as follows:

   School Code (copy & paste this): See above Point 3.

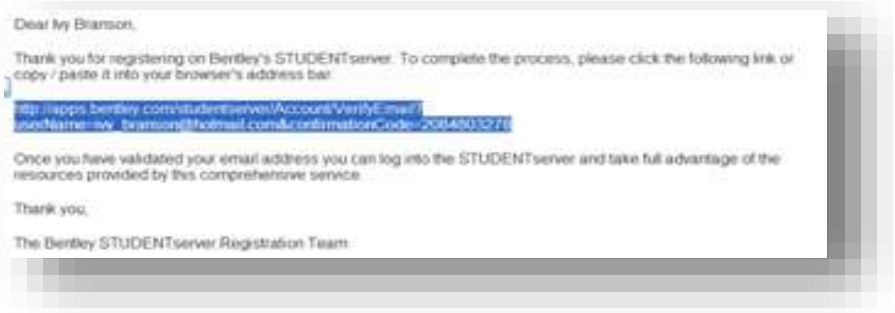
   E-mail (enter your correct email): A code will be forwarded to your email to complete the registration. Please ensure your email is entered correctly.

   First Name and Last Name: Entering your real name (instead of a nickname) will help you because your Transcript (which lists all courses completed by you) will display your name that you enter here. This Transcript will be available to you to augment your job applications even after you graduate and enter the workforce.



3) Confirmation will be displayed as follows. Click OK.

4) In a few minutes, you receive an email as follows. Please make sure you copy-and-paste the entire string into the address bar of your Internet Explorer.



5) After you have done that, you will see this confirmation and you may login immediately.
6) Note that once logged in, your name will appear as confirmation.

Congratulations!!! You have successfully registered yourself and may now begin to **Download Software** to your home computer or laptop, you may **Take Online Training**, you may **Review your Transcript** (record of your completed online courses) and access **Additional Academic Resources**.

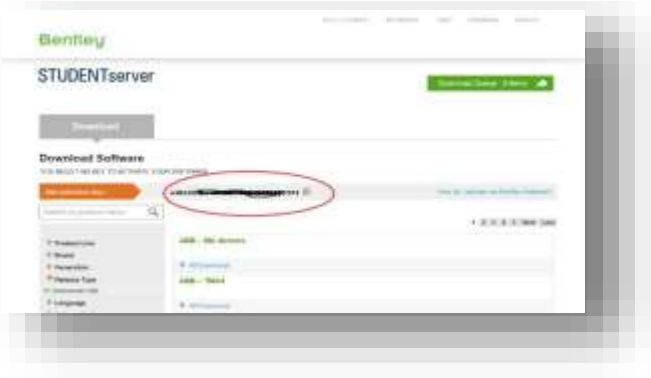
What is the Student Home Use Activation Key (also called Site Activation Key) and where do I find it?:

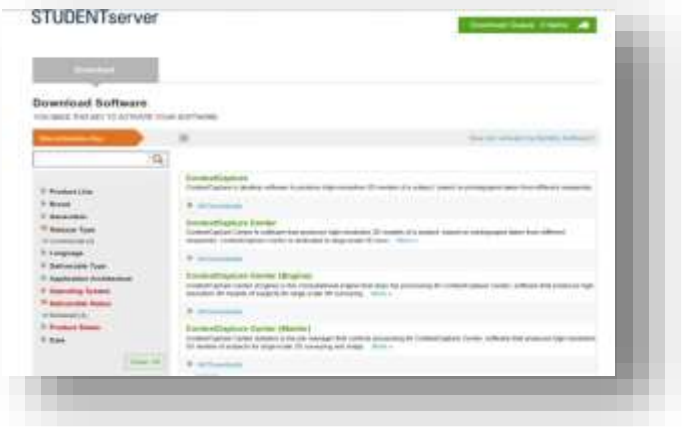
- It is used for activating software that you install on your laptop or home computer
- This Key is distributed directly to students and staff via STUDENTserver
- It is displayed after you login to STUDENTserver and after you click “Download Software”
- Copy-and-paste this Key and save it somewhere handy on your laptop
- During any software installation, you will be prompted to enter this key.
- YOU NEED TO CONNECT TO INTERNET WHEN YOU ARE ACTIVATING YOUR SOFTWARE
- After activation, you may be disconnected from the internet. However, you need to connect to the internet a minimum of once every 30 days.
- Alternatively, if you choose to activate at a later time, go into the Bentley SELECT XM License Manager Tool which may be found from within the software to enter the Key.

How do I download ContextCapture software?

1. Click “Download Software”

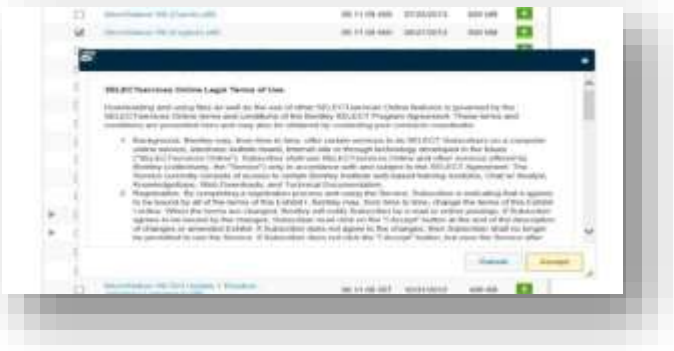
2. Notice that your Site Activation Key is displayed. You will need this later to activate your software. You might like to copy-and-paste this to a safe location.





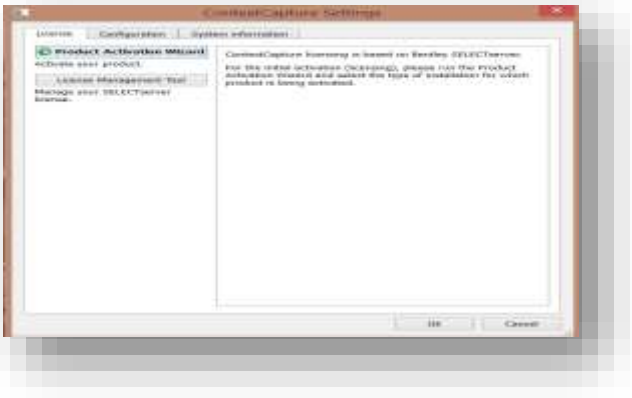
3. Click “All Downloads”. Click ContextCapture, Read the Terms & Conditions and click-> Accept.

Click “Accept”.

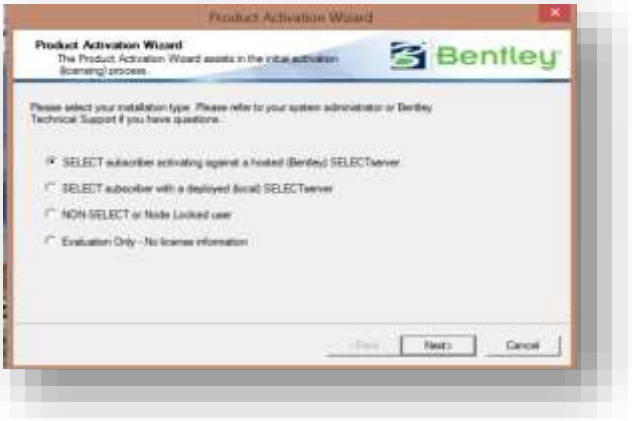


4. Save to your chosen folder or into the default “Bentley” folder.
5. When downloading is completed, go to the folder. Some students have noted that the file names do not have an “.exe” extension. If this happens, please change the file name so that it does.

6. Read and accept the terms of the End User Agreement, then click next. Click “Install”. Once you successfully install the Software, click on ContextCapture Settings icon at your desktop. Click on Product Activation wizard.



You may activate your software now or do it later.

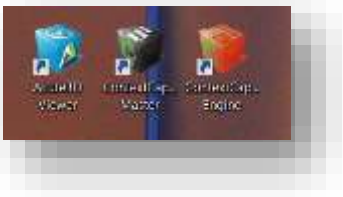


All student home use licenses are hosted.

Copy-and-paste your Activation Key. Click “Test Connection” to confirm, then click next. Enter your country, then click Next.

1) Leave all fields blank because you do NOT want to check out a license. Click Next. Then click Finish.

Click Install to finish the installation, then click Finish.
Similarly you may download, Install and activate “Acute3D Viewer.”



Student Entitlements

Through Bentley’s STUDENTServer & LEARNServer, Bentley Systems provides students and Faculty with over 50 software You may download and install any of these software to your laptop and home computer Click here for complete list.

ContextCapture: Guide to Use

How to Setup Camera?

Very different types of cameras can be used to capture an input dataset for Smart3DCapture, ranging from smartphones to the latest DSLR cameras. The quality of the resulting 3D models will depend on the quality of the input photos and their spatial configuration.

To get the best results in Smart3DCapture, we recommend:

- A constant focal length during the acquisition: zoom "with your feet",
- A constant and homogeneous Lighting

You must banish:

- Digital zoom,
- Any resizing/cropping/rotation of the input photos (turn off your camera's auto-rotation mode),
- Fish-eye lenses.

Limitations:

1. Enough photos have to be taken to cover the entire object to reconstruct. Every point of the scene must be captured at least in 2 adjacent photos.
2. Transparent or shiny parts cannot be properly reconstructed: glass, water, etc.
3. Parts of the object with a uniform aspect cannot be reconstructed: plain walls without texture, etc.
4. The photos looking at a same part should be taken from neither too similar nor too different points of view.

How to Capture Objects:

Capturing an object is among the simplest cases. This is what we recommend to get started with Smart3DCapture. Still, it requires a little bit of knowledge and practice to be done properly. Remember that each part you want to reconstruct must be seen in at least 2 different photographs.

An easy way to fulfill this is to turn around the object with small steps (ensure a minimum 60% overlap and a maximum angle difference of 15° between consecutive photos). Typically, you also want to get a uniform resolution. To achieve this, try to maintain the camera at the same distance from the object during all the acquisition (Figure 1)

Figure 1: Object acquisition

If you want to obtain more detail in some parts of the 3D model, progressively take photos closer and closer to the object. Having photo resolutions that are too different may lead to a failure during the aerotriangulation. This is why it is recommended to have medium range photos to link the ones that are shot at close and long ranges (Figure 2).

Figure 2: Capturing a part of the object in more detail

To make sure to scan all the details of the object, circle around it at different levels. This will reveal most hidden

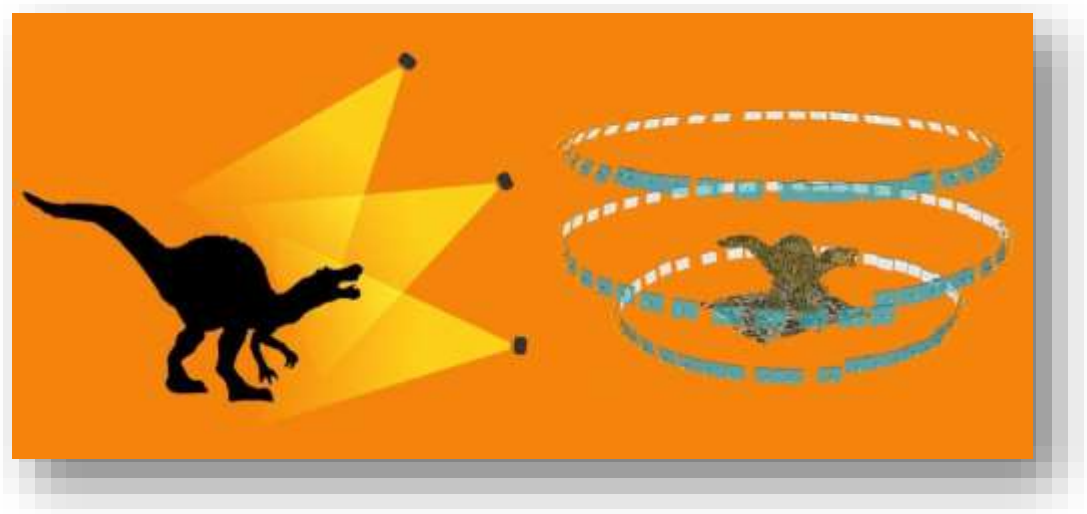


Figure 3: Circling at different levels

If the object has little texture, the aerotriangulation may fail due to an insufficient number of points of interest. To circumvent this, we recommend to place the object on a highly textured surface, for example a newspaper (Figure 4).

Figure 4: Using a highly textured surface

Capturing the bottom of the object is tricky since, in photogrammetry, the subject has to remain still during all the acquisition. When turning the object upside-down to capture the bottom, the background will not be consistent with the rest of the dataset, which will result in a failure. There

are several ways to deal with this difficulty:

- Taking photos of the object from all the needed points of view and masking the background manually in all the photos with a third-party image editing software (this process can be tedious).
- Creating a shooting "studio" / turntable method: it consists in a stand that is completely untextured. For example, use a white stand over a uniform white background and turn the object instead of turning around it. You will then be able to capture any part of the object without being bothered by the background (Figure 5).

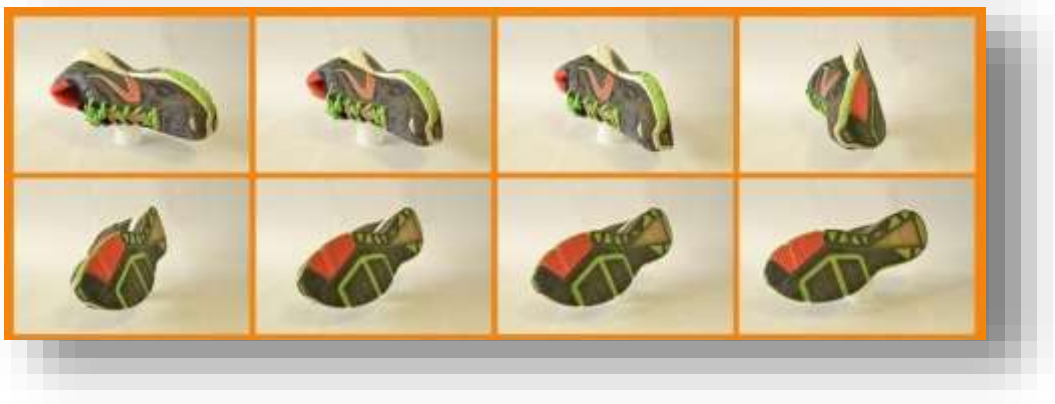


Figure 5: Turntable method

How to capture bodies and faces

Capturing a human face/body in order to create a 3D model can be really challenging. Indeed, the subject has to remain perfectly still during the whole acquisition, which is practically impossible to achieve with a living human.

This is why professionals generally use RIGs (rigid camera systems). These systems are composed of several cameras synchronized to shoot pictures simultaneously. The acquisition of the full dataset is instantaneous, thus avoiding unwanted movements of the subject. The camera setup should follow the same principles as for object scanning. With the difference that increasing the number of pictures of your dataset means increasing the number of physical cameras, with an impact on the cost of the system.

Figure 6: A rigid (abbr. RIG) camera system

If you cannot afford a rigid camera system, and need to capture human bodies and faces with a single camera, we recommend to keep the acquisition time as short as possible, since the odds of movements increase over time. Hair is also quite complicated to model correctly, so be extra careful when shooting it and do not forget to take photos of the top of the head. You should also try to reduce the amount of background in your photos and try to get as much subject as possible (Figure 6). The same applies to any type of scene.

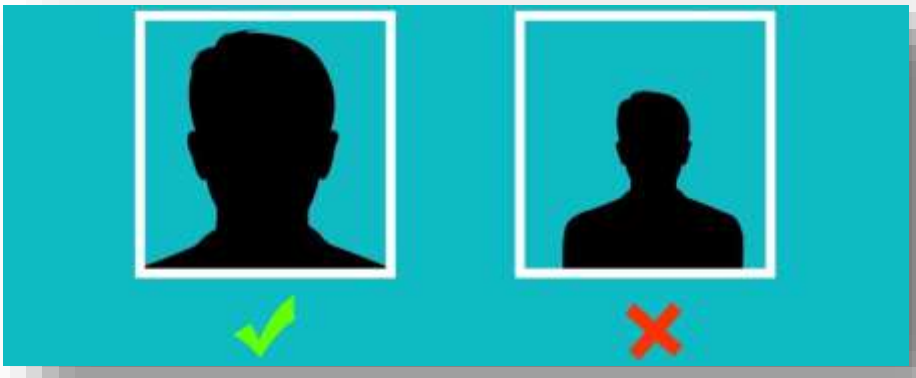


Figure 7: Avoid large background areas

How to capture façades and buildings

Some rules have to be followed in order to ensure a good acquisition:

- Follow a specific shooting order to avoid missing parts.

- Shoot at least 3 times the same part from different points of view.
- Limit the angle between two consecutive photos to a maximum of 15°.

The simplest way to capture a facade is to shoot photos from different evenly spaced stations, with different angles (Figure 7). Ensure a 60% overlap between two consecutive front views and a maximum angle of 15° for the side views.

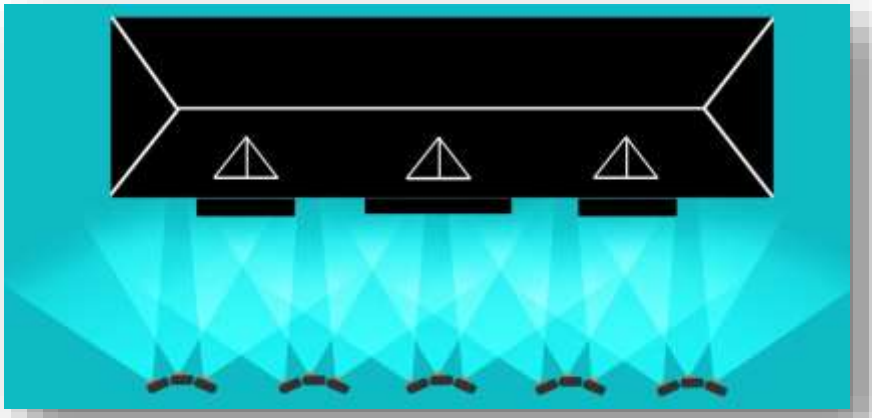


Figure 8: Facade scanning

If you want to reconstruct the complete building and not only a single facade, make sure to respect the maximum angle of 15° between two consecutive pictures when turning around the corner (Figure 9). This way, you will help Smart3DCapture to connect the two faces of the building.

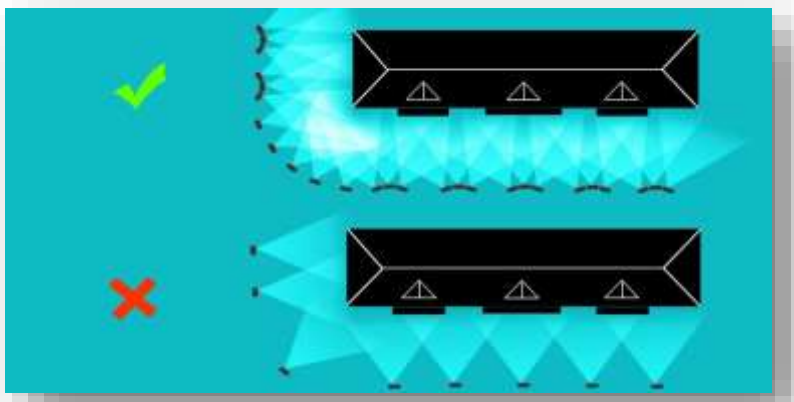


Figure 9: Turning around a building corner

If building cannot be photographed in all its height because of a lack of distance and/or because the building it too tall, you will have to reproduce the pattern of Figure 9 at several heights. This requires a lift, a mast or a UAS/UAV/drone. Otherwise, just take successive photos from bottom to top, respecting the 60% overlap rule. In such case, please note that Smart3DCapture may lack information to properly reconstruct the high parts and the roof.

When using a UAS, we recommend to circle around the building at different levels to limit hidden areas (Figure 10). In this case, you can complete your aerial dataset with ground photos.

Remember that reflective, shiny or transparent parts may be hard or even impossible to reconstruct

Figure 10: Circling around a building at different heights

How to capture interiors

Reconstructing interiors using photogrammetry is a difficult task. The short distance from the subject and the numerous objects creating masks increase drastically the number of photos needed to reconstruct the scene properly.

Figure 11 shows the correct acquisition pattern to capture interior scenes. To get the maximum distance from the scene, stand close to the wall and shoot the opposite side of the room. A common mistake consists in standing in the middle of the room and shooting in a panoramic way.

You may also need to reproduce the pattern of figure 11 at several heights. If tables or other pieces of furniture stand in the room, you will need extra photos to capture the bottom part of it.

Another common issue is the lack of texture on the walls. This may lead to holes in the 3D model,

or even a failure during aerotriangulation (see "Limitations" p.3).

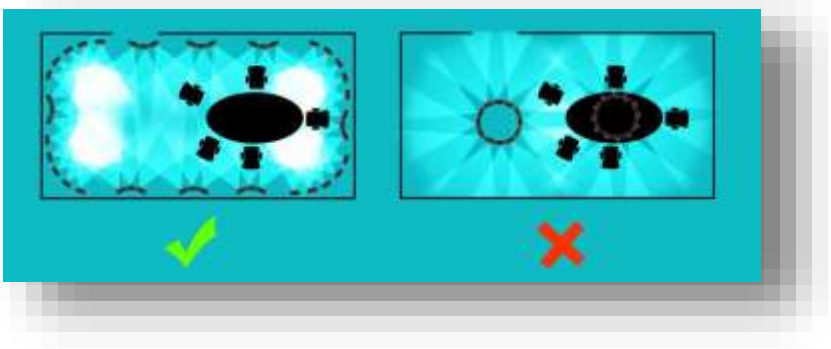


Figure 11 : advised interior acquisition

System Requirements:

ContextCapture natively runs under Microsoft Windows XP/Vista/7/8 64-bit.

It requires at least **8 GB of RAM** and **NVIDIA** or **AMD** graphics card, or **Intel** integrated graphics processor compatible with OpenGL 3.2 with at least 1 GB of dedicated memory.

Both desktop and rack-mounted computers are supported. Even multimedia or gaming laptops can be used, though with a significantly lower performance.

The following configuration is recommended: a recent desktop computer running under Microsoft Windows 7/8 Professional 64-bit with at least 16 GB of RAM, an 8-core CPU and an NVIDIA GeForce GTX 780 Ti graphics card. Please contact the technical support team to design more powerful configurations (GeForce GTX TITAN, Quadro, bi-Xeon, etc.).

Please note that ContextCapture does not take advantage of multiple GPU architecture.