

## Image and Video Analysis in R

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Open Science Framework location: <https://osf.io/k93zv/>

### ***COURSE DESCRIPTION***

This course will teach you how to extract data from still images and video. We will start with some background information about how images and video are rendered and compressed. Then we will quickly transition to importing images and video into R to extract information from them. When the course is done you should be able to extract numeric pixel data from still images and video frames, automatically identify and isolate objects in images, apply various filters to simplify complex images, and track objects over time in videos. The course will be based in the R programming environment, but we will draw from several important image processing tools including OpenCV.

Required packages: CMake and Rtools (binaries)  
ROpenCVLite (R package)  
OpenCV (installed via ROpenCVLite)  
Rvision (R package - difficult to install)  
trackR (R package)  
data.table (R package)  
devtools (R package)

#### Part 1: Basics of images

- How are images encoded?
  - Pixel arrays
  - Color vs grayscale images
- Image compression

#### Part 2: Working with images in R

- Importing still image
- Plotting, cropping, and resizing
- Applying thresholds
- Finding/counting objects

#### Part3: Working with video in R

- Loading video and importing frames

Background subtraction  
Masking  
Object tracking  
TrackR package

## **PREPARATION:**

This course assumes some familiarity with the R programming environment. You don't need to be an expert by any means, but you should be familiar with concepts like "working directory" and "data frame" as they apply to R. Also, you should be moderately familiar with how to install new packages.

A key element to preparing for this course is to get the required packaged loaded, and this may not be easy. The course material makes use of the **Rvision** package, which is mainly a way to connect the R programming environment to the OpenCV (open computer vision) library, which is written in C++. Therefore, to make Rvision work you have to have OpenCV on your computer as well. Fortunately, the authors of Rvision made another package called **ROpenCVLite**, which automates the process of installing OpenCV. I've done installations of Rvision and OpenCV (via ROpenCVLite) on both macs and pcs, but you have to follow the instructions closely, and you have to do everything in the right order. We will also use the **trackR package**, but it should install not problem if you have Rvision working

The instructions for installing Rvision are here: [https://swarm-lab.github.io/Rvision/articles/z1\\_install.html](https://swarm-lab.github.io/Rvision/articles/z1_install.html)

As you go through the instructions you will see that there are several preliminary steps that include installation of CMake and Rtools (both are binary packages, not R packages), as well as the R package Devtools. Getting CMake and Rtools (pc only) to install properly can be challenging. Here are some tips from my experiences

### **FOR PC**

1. For pcs, you can try to use the R package installr as stated in the instructions, but that did not work for me. So I first used the powershell to install Chocolatey:

<https://community.chocolatey.org/courses/installation/installing?method=install-from-powershell-v3>

Then I used Chocolatey to install Cmake and specifiy the path for all users:

<https://community.chocolatey.org/packages/cmake.install/3.13.1>

2. You can also use Chocolatey to install Rtools on a pc:

<https://community.chocolatey.org/packages/rtools>

There is also a special function in installr that installs Rtools for you:

<https://www.rdocumentation.org/packages/installr/versions/0.23.2/topics/install.Rtools>

### **FOR MAC**

Instructions here work pretty well for CMake:

<https://swarm-lab.github.io/ROpenCVLite/articles/install.html>

## FOR MAC & PC

1. **Devtools** installation should be straightforward. You can just do it in Rstudio with the Install button in the Packages tab.

2. Once Devtools is installed you can proceed with **ROpenCVLite** and **OpenCV** as described here:

<https://swarm-lab.github.io/ROpenCVLite/articles/install.html>

**Note that this can take an hour or so!!!**

3. Then finally you can install **Rvision** and **trackR** in R:

```
library(devtools)
remotes::install_github("swarm-lab/Rvision")
remotes::install_github("swarm-lab/trackR")
```

Some troubleshooting tips for newer macs:

I had some issues installing on a new mac with an M1 chip. First problem was that you need a certain version of R, which I found here: <https://cran.r-project.org/bin/macosx/>. Look for the version described as “**R 4.2.1** binary for macOS 11 (**Big Sur**) and higher, **Apple silicon arm64** build.”

The second problem was a bad version of gfortran. I had to get a special version from <https://mac.r-project.org/tools/>. If you need this download the version for Apple Silicone Macs and follow the install instructions.