gopro max stills 2 kmz converter

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TL;DR

This windows only workflow creates a .kmz file from geocoded 360° images taken with a GoPro Max. It involves package setup, file renaming, selecting images by distance (20m default), adding overlays (optional), creating a .kml file, then finally converting everything to a .kmz file for use in the pannotator package for annotating. To use this script open the pannotator_collect.Rproj in RStudio, then open this file (goproMaxStills2KmzConverter.qmd) and **RUN EACH CODE CHUNK IN ORDER USING THE PLAY ARROW AT THE TOP-RIGHT CORNER OF THE CHUNK** to create a .kmz file. The latest version of this script and other workflows can be found at pannotator_collect.

Description of the Workflow

This workflow has been developed to allow easy creation of .kmz files from 360 degree panospheric images. These can be taken with a gopro Max camera or most consumer drones like those made by DJI. The overlay may need to be adjusted depending on the size of the images generated etc.

Any geocoded equirectangular images (jpegs) can be used, regardless of how they were created, but this workflow is specifically tailored to the gopro Max.

Before using this script we recommend making a backup of the original camera files just in case as this script edits the files directly.

The workflow code below is as follows:

1. Check and install required packages
2. Set user options:

   > folder containing 360 degree images (jpgs)
   > distance between images (metres)
   > add overlays (True/False)
   > overlay file to use (png with transparency)

3. Rename the files (only renames files if names are 12 characters long)
4. Get subset of images a specified distance apart (defaults to 20m)
5. Add overlays to the images (optional)
6. Create a google earth .kml file
7. Convert the .kml file and associated images into a single .kmz file

The resulting .kmz file can then be used in the pannotator package for annotating.

Check & Install Required Packages

In order for this workflow to function as expected there are a few dependent packages to install and configure. In RStudio use the play arrow at the top-right corner of the code chunks to run them.

```r
dependentPackages <-
  c("svDialogs",
    "tools",
    "exiftoolr",
    "geosphere",
    "stringr",
    "gpx",
    "magick",
    "fs",
    "magrittr",
    "zip",
    "readr",
    "usefun"
  )

for (i in dependentPackages) {
  print(paste0("Checking for: ", i))

  # First check if you have the package installed
  check_for_package <- system.file(package = i)
  print(check_for_package)

  # If not run the following code to install it.
  if (check_for_package == "") {
    print(paste0(i, " package not found .....installing now"))
    install.packages(i)
  } else {
    print(paste0(i, " package is already installed"))
  }
}
```

Set User Options (manual version)

Here we manually set the user options which will be used in the following code chunks.

```r
# Specify the folder containing the goPro images
# (Windows) use forward slashes only
 directory <-  "C:/Users/username/pannotator_collect/gopro_images"

# Select the minimum distance in metres between each extracted image.
```

```r
metresBetweenEachImageWanted <- 100

# Set to TRUE to add overlays to each image file; or FALSE to use
↪  images without any overlays.
addOverlays <- TRUE

# Conditionally set the overlay image file if addOverlays is TRUE
if (addOverlays == TRUE) {
  # specify file path manually.
   overlayImageFile <-
↪  "./overlay_files/5m_overlay_wedges_straight6.png"
} else if (identical(addOverlays, FALSE) || length(addOverlays) == 0)
↪  {
  overlayImageFile <- NULL
}
```

Set User Options (svDialogs GUI version)

Here we set the user options using GUI popups which will be used in the following code chunks.

If you want to use this as an alternative to the manual version above, uncomment it and run it instead.

```r
# svDialogs::msgBox("There will be several popup dialogs so you can
↪  select 1:Directory Containing 360 Images 2:Minimum Distance
↪  Between images 3:Add overlay to images 4:Select overlay image file
↪  (png)")
#
# # Choose the directory path containing 360 images.
# directory <- svDialogs::dlg_dir(default = getwd(), title = "Select
↪  Directory Containing 360 images")$res
#
# # Select the minimum distance in metres between each extracted
↪  image.
# metresBetweenEachImageWanted <- svDialogs::dlg_input(message =
↪  "Enter a value for: metresBetweenEachImageWanted", default =
↪  "100")$res
#
# # Set to TRUE to add overlays to each image file; or FALSE to use
↪  images without any overlays.
```

```r
# addOverlays <- svDialogs::dlg_input(message = "Add Overlays to images? (TRUE/FALSE)", default = "TRUE")$res
#
# # Conditionally set the overlay image file if addOverlays is TRUE
# if (addOverlays == TRUE) {
#   # Choose the file for your desired overlay image (PNG image with transparency).
#   overlayImageFile <- svDialogs::dlg_open(default = "./overlay_files", title = "Select overlay file (png)", multiple = FALSE, filters = svDialogs::dlg_filters["png", ])$res
# } else if (identical(addOverlays, FALSE) || length(addOverlays) == 0) {
#   overlayImageFile <- NULL
#   }
#
# finalMessage <- paste0("You have selected: Folder with 360 Images: ", directory,
#    " Metres Between Each Image Wanted: ", metresBetweenEachImageWanted, " AddOverlays: ", addOverlays)
# if (addOverlays == TRUE) {
#   finalMessage <- paste0(finalMessage, " Overlay Image File: " , overlayImageFile)
# }
#
# svDialogs::dlg_message(message =finalMessage, type = "ok")
```

Rename Files

By default most consumer cameras like the gopro max & DJI drones don't allow the user to specify the file names they apply to images that they create.

A typical file name follows the format GS__XXXX.JPG - where XXXX is a counter number of the images taken by the camera.

To address this issue and make it easier to manage the files for processing, this code prepends the date_time stamp to the beginning of the files in a given directory. It's useful for organising files when doing field work, especially when using multiple cameras at the same time.

The output format is: YYYYMMDD_HHMMSS_FileName.ext

Note: Gopro now have a custom firmware allowing you to set file names in the field; see this GoPro Labs link.

This code checks the file name length initially assuming that files names directly downloaded from the camera are 12 characters long. If the files used have longer file names they will not be renamed. This ensures they are only renamed once.

```r
library(exiftoolr)
library(stringr)
library(tools)

# Check if 'directory' is set and valid, throw an error if not
if (!exists("directory") || !dir.exists(paste0(directory)) ||
↪ length(directory) == 0) {
  stop("'directory' does not exist. Please run the code chunk under
  ↪ 'Set User Options' above to set the directory containing the 360
  ↪ images."
  )
}

# filter only .jpg or .JPG files
file_extension <- "\\.[Jj][Pp][Gg]$"

my_files <-
  list.files(
    directory,
    pattern = paste0("*", file_extension),
    all.files = FALSE,
    full.names = TRUE
  )

#read the exif information in the file to get the creation date
files_df <- exiftoolr::exif_read(my_files, args = c("-G1", "-a",
↪ "-s"))

#Loop through the files and check to change file names
#this checks if the files have already been changed by looking at the
↪ length of the file name.
for (i in 1:nrow(files_df)) {
  print("Checking if camera file name has not been changed")
  if (nchar(files_df[i, "System:FileName"]) == 12) {
    print("File appears to be 12 characters long")
    print(paste0("SourceFile: ", files_df[i, "SourceFile"]))
    origFullFileName <- paste0(files_df[i, "SourceFile"])
    createDate <- paste0(files_df[i, "ExifIFD:DateTimeOriginal"])
    print(paste0("CreateDate: ", createDate))
    formattedCreateDate <- stringr::str_replace_all(createDate, ":", "")
    formattedCreateDate <- stringr::str_replace_all(formattedCreateDate, " ", "_")
    print(paste0("formattedCreateDate: ", formattedCreateDate))
    file_ext <- tolower(tools::file_ext(files_df[i, "System:FileName"]))
    newFileName <- paste0(files_df[i, "System:Directory"], "/", formattedCreateDate,"_",tools::file_path_sans_ext(basename(files_df[i, "System:FileName"])), ".",file_ext)
    print(paste0("newFileName: ", newFileName))
    file.rename(from = origFullFileName, to = newFileName)
    print("File name changed")
  } else {
    print(
      "It appears that the file has already been renamed as it's greater than 12 characters long"
    )
    print(paste0("SourceFile: ", files_df[i, "SourceFile"]))
  }

}
```

Function to Calculate Distances Between Image Geo-Locations.

This code looks through all the files in a given folder and copies images a user-specified distance apart into a new folder for use later on. It starts with the first file and looks for a file at least XX metres from that. Once it finds one it adds it to the list then uses it as the location to look for another file at least XX metres from it and so on until it gets to the end of the file list. This method is most suitable for linear transect sampling but should work with any images that are spaced out enough.

```r
library(geosphere)

options(digits = 20)
options(digits.secs = 20)
options(scipen = 9999)

#function which takes 2 arguments
#1:gpx_locations - a dataframe containing 4 columns("SourceFile",
↪  "System:Directory", "Composite:GPSLongitude",
↪  "Composite:GPSLatitude")
#2:distance in metres between each image to extract. (default=20m)
findImagesEveryXmetres <-
  function(my_gpx_locs, metresToNextImage = 20) {
    gpx_locs <- my_gpx_locs

    keeps <- c("Composite:GPSLongitude", "Composite:GPSLatitude")
    points <- gpx_locs[keeps]

    #View(points)
    #View(gpx_locs)

    #calculate the distance between any two points
    distance_m <- geosphere::distm(points , fun =
↪   geosphere::distHaversine)
    rownames(distance_m) <- basename(gpx_locs[, "SourceFile"])
    colnames(distance_m) <- basename(gpx_locs[, "SourceFile"])

    #View(distance_m)

    #find images a certain distance apart.
    selected_files <- vector()

    metres_between_images <- metresToNextImage

    print(paste0(
      "Searching for images apart by: ",
      metres_between_images,
      " metres"
    ))

    for (i in 1:nrow(distance_m)) {
      if (i == 1) {
        #if it is the first frame add it as the current frame
        selected_files <-
          append(selected_files, rownames(distance_m)[i])
        current_frame <- rownames(distance_m)[i]
        print(paste0("Frame 1: ", current_frame))
        print(paste0(
          "looking for frame >",
          metres_between_images ,
          " Metres from frame 1"
        ))
      }#if the current frame is greater than the specified metres
      if (distance_m[i, current_frame] > as.numeric(metres_between_images)) {
        current_frame <- rownames(distance_m)[i]
        print(paste0("current_frame: ", current_frame))
        selected_files <- append(selected_files, current_frame)
      }

    }
    print(paste0("Files found:", selected_files))

    new_folder <-
      paste0(gpx_locs[1, "System:Directory"], "_", metres_between_images, "m_apart")

    dir.create(new_folder)

    source_folder <-  dirname(gpx_locs[1, "SourceFile"])

    print(gpx_locs[1, "System:Directory"])

    for (q in selected_files) {
      file_to_copy <- paste0(source_folder, "/", q)
      destination <- paste0(new_folder,  "/", q)
      file.copy(
        file_to_copy,
        destination,
        overwrite = TRUE,
        recursive = FALSE,
        copy.mode = TRUE,
        copy.date = TRUE
      )
    }

  }

print("findImagesEveryXmetres(my_gpx_locs, metresToNextImage) function
↪  is now available to call")
```

Call Function Above

Now call the function above to calculate the minimum distance (m) between images and copy them to a new folder.

```r
library(exiftoolr)

# Check if 'directory' is set and valid, throw an error if not
if (!exists("directory") || !dir.exists(paste0(directory)) ||
↪  length(directory) == 0) {
  stop("'directory' does not exist. Please run the code chunk under
  ↪  'Set User Options' above to set the directory containing the 360
  ↪  images."
  )
}

file_extension <- "\\.[Jj][Pp][Gg]$"

my_files <-
  list.files(
    normalizePath(directory, winslash = "/"),
    pattern = paste0(file_extension),
    all.files = FALSE,
    full.names = TRUE
  )

image_files_df <-
  exiftoolr::exif_read(my_files, args = c("-G1", "-a", "-s"))

#View(image_files_df)

gpx_locs <-
  as.data.frame(image_files_df[, c(
    "SourceFile",
    "System:Directory",
    "Composite:GPSLatitude",
    "Composite:GPSLongitude"
  )])

#View(gpx_locs)

if (!exists("metresBetweenEachImageWanted") ||
 ↪  length(metresBetweenEachImageWanted) == 0) {
  print("'metresBetweenEachImageWanted' does not exist. Using Default
   ↪  value. Please run the code chunk under 'Set User Options' above
   ↪  if you want to change the metresBetweenEachImageWanted")
  findImagesEveryXmetres(my_gpx_locs = gpx_locs)
} else {
  findImagesEveryXmetres(my_gpx_locs = gpx_locs, metresToNextImage =
   ↪  metresBetweenEachImageWanted)
}
```

Add Overlays to the Images

The code below goes through the images in the folder created above and adds an overlay file to them. This overlay must be specific to the camera used to create the 360 degree images as the focal length of the lens etc. will define how the overlay should look.

In this example we used a gopro Max at 3.2m above the ground. The easiest way to determine how an overlay should look is to take some images with the camera at the specified height with the desired overlay marked on the ground so you have an easy template to base your overlay on.

Here we wanted a circular marker with a 5 metre radius and we were lucky to find a round concrete water tank buried in the ground with the required radius. We marked the distance in metres from the centre of the plot directly under the camera using a pole with black marking tape at 1 metre intervals. Below is the image loaded into inkscape so we could draw the required marker lines for the overlay.

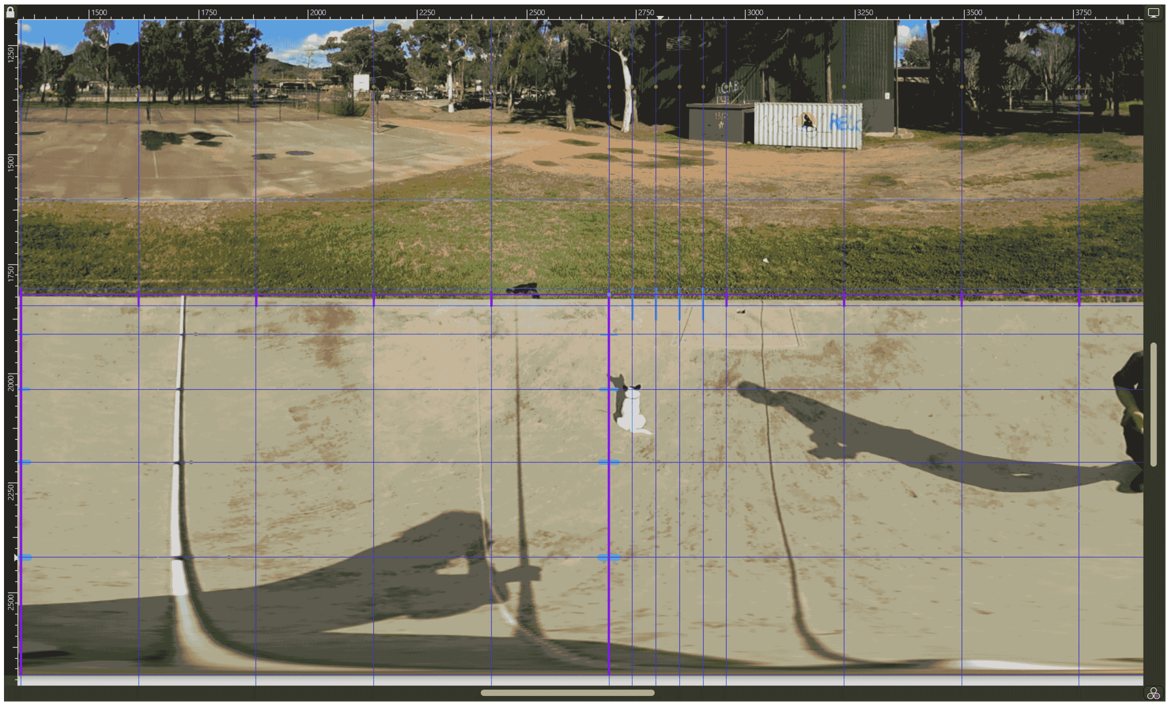

Figure 1: overlay image with camera background

Note: There is a slight discrepancy with the line on the right side of the image. This is due to the camera not being exactly vertical when capturing the image.

The overlay was created using inkscape and then exported as a portable network graphics (.png) file with transparency. See the example below:

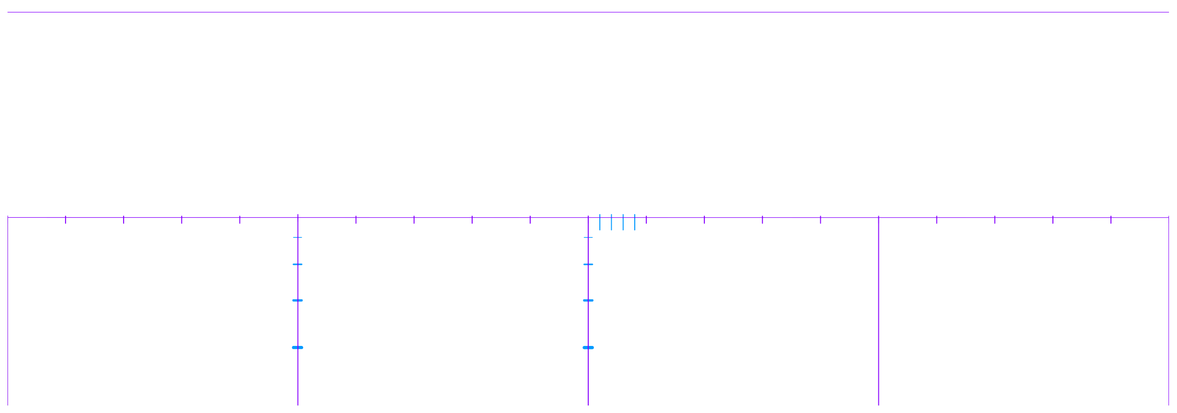

Figure 2: overlay image with transparency

Code to Create Overlays (magick version)

The code below uses imagemagick to load the underlying base file and then overlays the .png and saves out the flattened file for use in the kml/kmz files in the following steps.

```r
library(magick)
library(tools)
library(magrittr)

# Check if 'directory' is set and valid, throw an error if not
if (!exists("directory") || !dir.exists(paste0(directory)) ||
  length(directory) == 0) {
  stop("'directory' does not exist. Please run the code chunk under
    'Set User Options' above to set the directory containing the 360
    images."
  )
}

# if 'metresBetweenEachImageWanted' doesn't exist then add the default
  metres between images
if (!exists("metresBetweenEachImageWanted") ||
  length(metresBetweenEachImageWanted) == 0) {
  print("'metresBetweenEachImageWanted' not selected...using default:
    Please run the code chunk under 'Set User Options' above to set
    the metresBetweenEachImageWanted."
  )
  metresBetweenEachImageWanted <- 20
}

# if 'addOverlays' doesn't exist then throw an error asking to set
 ↪  'addOverlays'
if (!exists("addOverlays") || length(addOverlays) == 0) {
  stop("'addOverlays' does not exist. Please run the code chunk under
   ↪  'Set User Options' above to set the addOverlays.")
}

if (addOverlays == TRUE) {
  overlay_file <- overlayImageFile

  new_directory <-  paste0(directory,
                           "_",
                           metresBetweenEachImageWanted,
                           "m_apart")

  if (!dir.exists(paste0(new_directory))) {
    print(paste0(new_directory, " does not exist!"))
  stop("Did you run the code chunk above to find images a certain
   ↪  distance apart?"
  )
}
  # first create a new directory to add the overlay images to
  dir.create(paste0(new_directory, "/with_overlay/"))

  file_extension <- "\\.[Jj][Pp][Gg]$"

  files_lst <-
    list.files(
      new_directory,
      pattern = paste0(file_extension),
      all.files = FALSE,
      full.names = TRUE,
      recursive = FALSE,
      include.dirs = FALSE
    )

  for (t in 1:length(files_lst)) {
    background_image <- magick::image_read(files_lst[t])
    overlay <-
      magick::image_read(overlay_file)
    image_dir <- dirname(files_lst[t])
    overlay_image_dir <- paste0(image_dir, "/with_overlay/")
    new_filename <-
      paste0(overlay_image_dir,
             basename(tools::file_path_sans_ext(files_lst[t])),
             "_with_overlay.jpg")
    print(paste0("Adding overlay to create: ", new_filename))
    img <- c(background_image, overlay) %>%
      magick::image_flatten(.) %>%
      magick::image_write(., new_filename, format = "jpg")
  }

} else {
  print("'addOverlays' not TRUE: No overlay files generated")
}
```

Generate kml File

This code generates a google earth kml file linking to the image files in the folder generated above. It uses ExifTool with a template “kml_hide_rollover.fmt” to create the kml file.

```r
library(readr)

# Check if 'directory' is set and valid, throw an error if not
if (!exists("directory") || !dir.exists(paste0(directory)) || length(directory) == 0) {
  stop("'directory' does not exist. Please run the code chunk under 'Set User Options' above to set the directory containing the 360 images."
  )
}

# if 'metresBetweenEachImageWanted' doesn't exist then add the default metres between images
if (!exists("metresBetweenEachImageWanted") || length(metresBetweenEachImageWanted) == 0) {
  print("'metresBetweenEachImageWanted' not selected...using default: Please run the code chunk under 'Set User Options' above to set the metresBetweenEachImageWanted."
  )
  metresBetweenEachImageWanted <- 20
}

if (addOverlays == TRUE) {

new_directory <-
  paste0(directory,
         "_",metresBetweenEachImageWanted,
         "m_apart/with_overlay")

output_kml <-
   normalizePath(paste0(directory,
         "_",
         metresBetweenEachImageWanted,
         "m_apart_with_overlay.kml"), winslash = "/", mustWork =
          ↪  FALSE)
} else if(addOverlays == FALSE || length(addOverlays) == 0) {
  new_directory <-
  paste0(directory,
         "_",
         metresBetweenEachImageWanted,
         "m_apart")

output_kml <-
  normalizePath(paste0(directory,
         "_",
         metresBetweenEachImageWanted,
         "m_apart.kml"), winslash = "/", mustWork = FALSE)
}

exif_args <- c("-p", "kml_hide_rollover.fmt", "-r")
exiftoolr::exif_call(
  args = exif_args,
  path = new_directory,
  stdout = output_kml,
  quiet = FALSE
)

# now fix the links to the images to make them relative.
mystring <- readr::read_file(output_kml)
```

```r
path_only <- paste0(dirname(output_kml))
# check if the folder is root of the drive
if(nchar(path_only) == 3){
  mystring2 <- gsub(path_only, "./", mystring, fixed = T)
} else {
  mystring2 <- gsub(path_only, ".", mystring, fixed = T)
}

# Write the file out
sink(paste0(output_kml))
  writeLines(mystring2)
sink()

print(paste0("generated kml file: ", output_kml))
```

Convert kml & Images into a kmz File

This code reads the .kml file created above and converts it to a .kmz file. This involves zipping up the images and the .kml file into one file. It also edits the relative links etc. The convenience of the kmz file is that it combines the kml and associated images into one file.

NOTE: This code can generate kmz files >2GB. These files won't open correctly in the web version of Google Earth or Google Earth Pro but are not corrupt and will work fine in pannotator. This is a limitation of google earth pro being 32 bit. You can read about it here. Kmz files <2GB in size can be viewed in Google Earth Pro.

```r
library(fs)
library(usefun)
library(readr)
library(stringr)
library(zip)

# Check if 'directory' is set and valid, throw an error if not
if (!exists("directory") || !dir.exists(paste0(directory)) ||
↪   length(directory) == 0) {
  stop("'directory' does not exist. Please run the code chunk under
   ↪   'Set User Options' above to set the directory containing the 360
   ↪   images."
  )
}

# if 'metresBetweenEachImageWanted' doesn't exist then add the default metres between images
if (!exists("metresBetweenEachImageWanted") || length(metresBetweenEachImageWanted) == 0){
  print("'metresBetweenEachImageWanted' not selected...using default: Please run the code chunk under 'Set User Options' above to set the metresBetweenEachImageWanted."
  )
  metresBetweenEachImageWanted <- 20
}

if (addOverlays == TRUE) {

new_directory <-
  paste0(directory,
         "_",
         metresBetweenEachImageWanted,
         "m_apart/with_overlay")

output_kml <-
  normalizePath(paste0(directory,
         "_",
         metresBetweenEachImageWanted,
         "m_apart_with_overlay.kml"), winslash = "/", mustWork = FALSE)
} else if(addOverlays == FALSE || length(addOverlays) == 0) {
  new_directory <-
  paste0(directory,
         "_",
         metresBetweenEachImageWanted,
         "m_apart")

output_kml <-
  normalizePath(paste0(directory,
         "_",
         metresBetweenEachImageWanted,
         "m_apart.kml"), winslash = "/", mustWork = FALSE)
}

```

```r
print("Generating kmz file for:")
print(output_kml)

kml_file_name <- basename(output_kml)
kml_image_directory <- new_directory

dir_to_copy <- normalizePath(kml_image_directory, winslash = "/", mustWork = FALSE)
temp_folder <- paste0(usefun::get_parent_dir(directory), "temp")
new_dir_path <- normalizePath(paste0(temp_folder, "/files/"), winslash = "/", mustWork = FALSE)

fs::dir_copy(dir_to_copy, new_dir_path, overwrite = TRUE)
fs::file_copy(output_kml, temp_folder, overwrite = TRUE)
file.rename(
  from = file.path(temp_folder, kml_file_name),
  to = file.path(temp_folder, "doc.kml")
)

#clean up all of the extra line breaks in the kml file
mystring <- readr::read_file(file.path(temp_folder, "doc.kml"))
mystring2 <- gsub('\r\r\r\r\r\n', '\n', mystring, fixed = T)
mystring3 <- gsub('\r\r\r\r\n', '\n', mystring2, fixed = T)
mystring4 <- gsub('\r\r\r\n', '\n', mystring3, fixed = T)
mystring5 <- gsub('\r\r\n', '\n', mystring4, fixed = T)
mystring6 <- gsub('\n\r\n', ' ', mystring5, fixed = T)

# Extract the part of the string after the last '/'

if (addOverlays == TRUE) {
last_part_dir <- tail(strsplit(dir_to_copy, "/")[[1]], 2)
mykml <-
  stringr::str_replace_all(mystring6[1], paste0("src='./", last_part_dir[1],"/", last_part_dir[2]), "src='files")
}  else if(addOverlays == FALSE) {
  last_part_dir <- tail(strsplit(dir_to_copy, "/")[[1]], 2)
mykml <-
  stringr::str_replace_all(mystring6[1], paste0("src='./", last_part_dir[2]), "src='files")
}

```

```r
mykml <- stringr::str_replace_all(mykml[1], "<name>./", "<name>")
sink(paste0(file.path(temp_folder, "doc.kml")))
writeLines(mykml)
sink()

# name for new kmz file
kmz_file_name <-
  paste0(usefun::get_parent_dir(directory),"/",
         basename(tools::file_path_sans_ext(output_kml)),
         ".kmz")

# create the kmz file
myWd <- normalizePath(temp_folder, winslash = "/", mustWork = FALSE)
files_lst <-
  list.files(
    path = temp_folder,
    pattern = "*.jpg|*.kml",
    all.files = FALSE,
    full.names = FALSE,
    recursive = TRUE,
    ignore.case = FALSE,
    include.dirs = FALSE
  )

# zip the file up
zip::zip(
  kmz_file_name,
  files_lst,
  recurse = FALSE,
  compression_level = 9,
  include_directories = TRUE,
  root = myWd,
  mode = "mirror"
)

# remove the temp folder and its contents
unlink(temp_folder, recursive = TRUE)
```