

# My Photos Search

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*Team #75 (team of 1)*

# Overview of My Photos Search Project

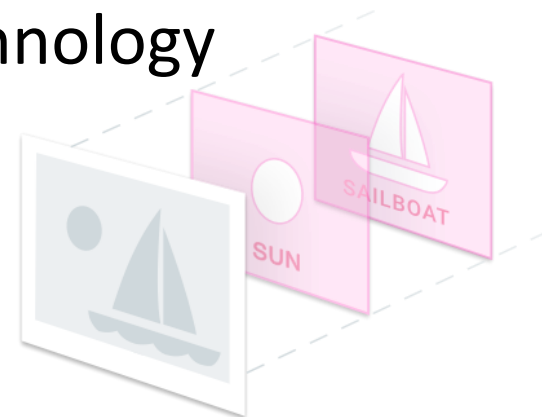
- Problem definition
- Novelty of my project
- Google Vision API
- General approach
- Implementation Details (+ Architecture)
- System snapshots
- Installation options
- Key learnings and further extension

# Problem definition

- As of today, end-user has quite limited ability to perform **content search** for images dataset that is stored on his/her computer or on one of commonly known service providers (Google Drive, Dropbox, Instagram, Facebook, ...)
  - *Disclaimer: basic attributes search is typically available (picture date, picture name, picture size, ...)*


# Novelty of my project


- The only such tool existing today is usual file search provided by Windows and it is quite limited as it allows only basic search based on “physical” attributes of the picture (date, size, type, name...)
- **My Photos Search** improves the search immensely, as it introduces efficient content search, while implementing state-of-the-art [Google Vision API](#) technology



# Google Vision API

- Enables to **understand the content of an image** by encapsulating **powerful machine learning models** in an easy to use REST API
- Rapidly **classifies** images into thousands of categories (e.g., "boat", "lion", "Eiffel Tower"), **detects** faces with associated emotions, and **recognizes** printed words in many languages. Hereunder are main general classifications/capabilities:
  - Label/Entity Detection picks out the dominant entity (e.g., a car, a cat) within an image
  - Optical Character Recognition to retrieve text from an image
  - Safe Search Detection to detect inappropriate content within your image
  - Facial Detection can detect when a face appears in photos, along with associated facial features
  - Landmark Detection to identify popular natural and manmade structures
  - Logo Detection to identify product logos within an image

Labels	Web	Properties	Safe Search	JSON
				
lake-hill-cloud.jpg				
			Reflection	97%
			Nature	96%
			Green	95%
			Water	94%
			Water Resources	90%
			Sky	89%
			Lake	88%
			Mountainous Landforms	88%

Labels	Web	Properties	Safe Search	JSON
				
tags-ears-tagging.jpg				
<pre>{   "labelAnnotations": [     {       "mid": "/m/0jz1",       "description": "cattle like mammal",       "score": 0.96239656     },     {       "mid": "/m/04lmyz",       "description": "horn",       "score": 0.9579255     },     {       "mid": "/m/01280g",       "description": "wildlife",       "score": 0.9280709     },     {       "mid": "/m/01c7cc",       "description": "grassland",       "score": 0.8820381     },     {       "mid": "/m/035ghg",       "description": "fauna",       "score": 0.8790381     }   ] }</pre>				

# General approach

## Identify Data Source

(User laptop / USB drive /  
Google Drive / Google Photos  
/ Instagram / Facebook / ...)



## Apply Google Vision API labeling per Image

(Identify and Store (caching))



## Create Index

For each picture - send all  
labels to Lucene engine for  
Index creation



## Get User search query (string)



## Run search query (based on the search term)



## Return relevant images (based on ranking and in descending order)

**Iterative  
Process**

# Implementation details

- Sample dataset was used by downloading ~6,300 pictures from <http://visualhunt.com> (free license)

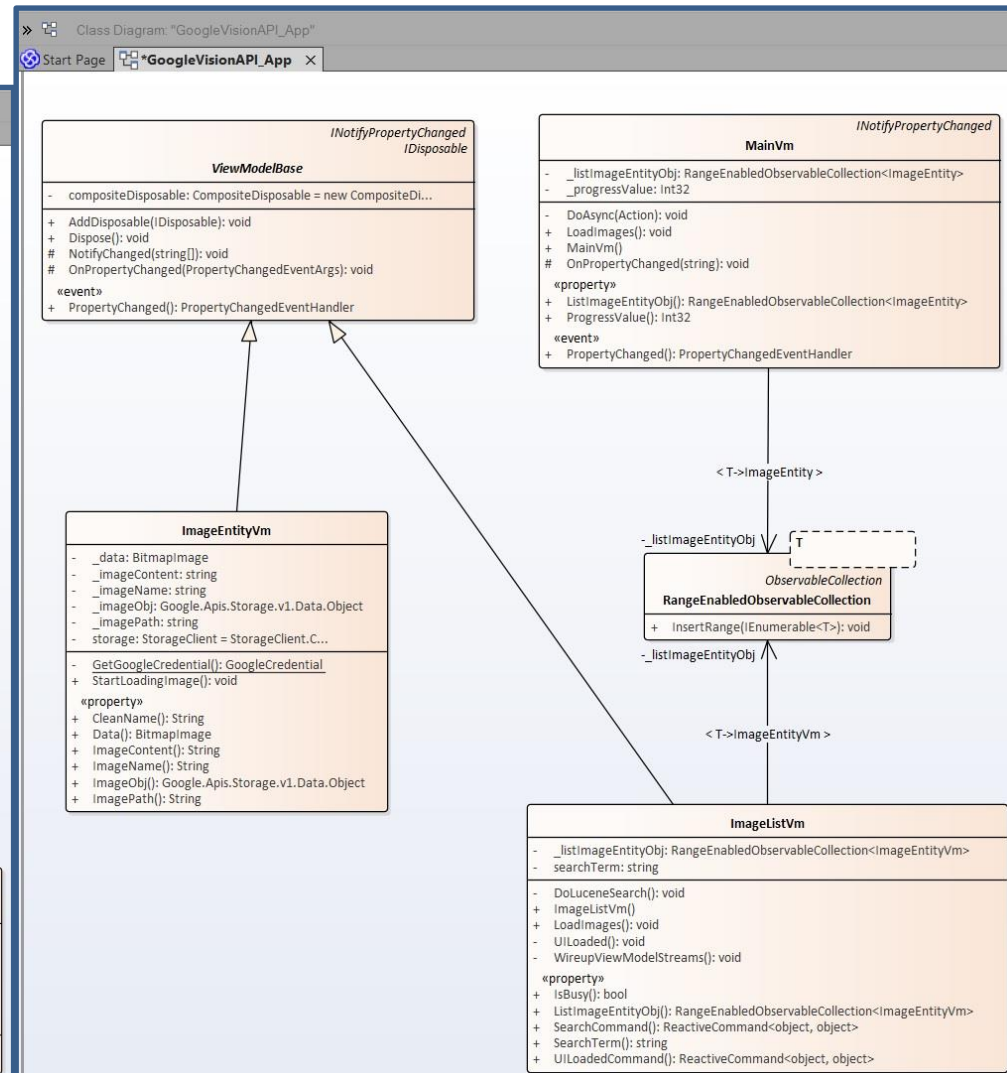
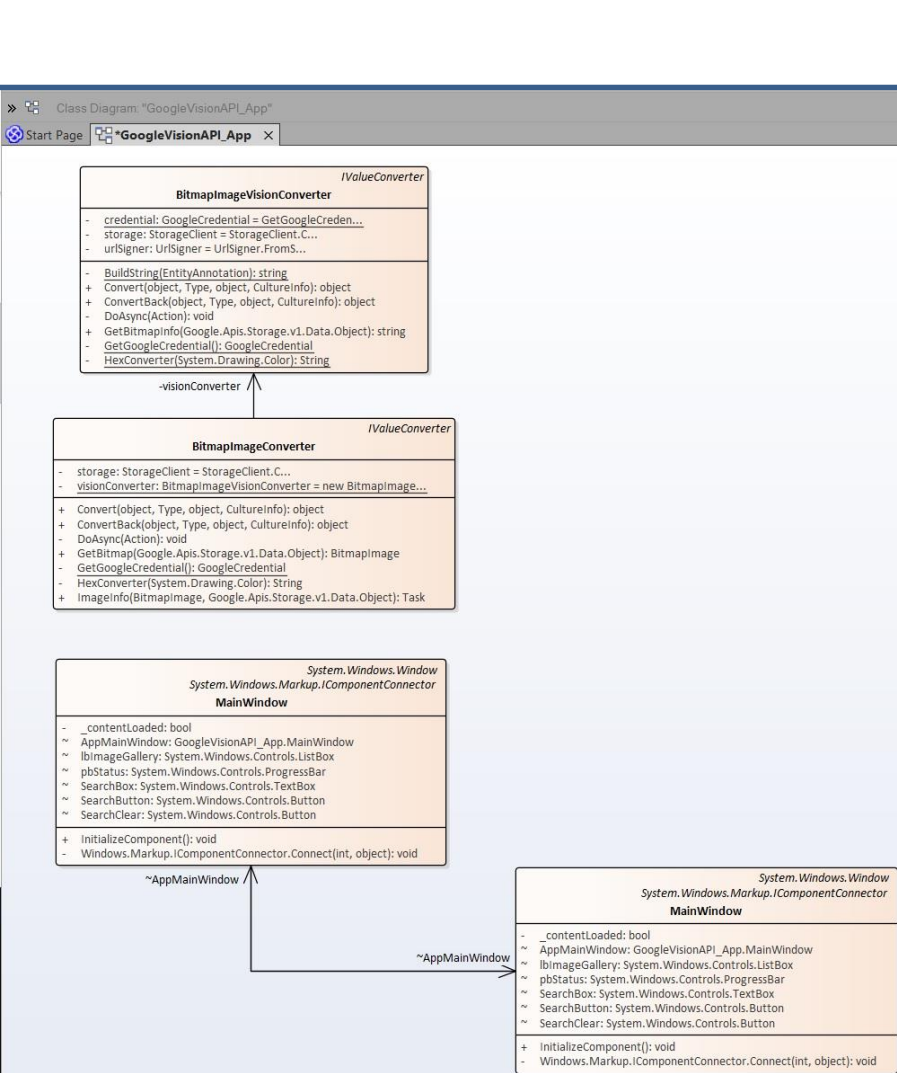


- Google Cloud Storage was selected to host the images



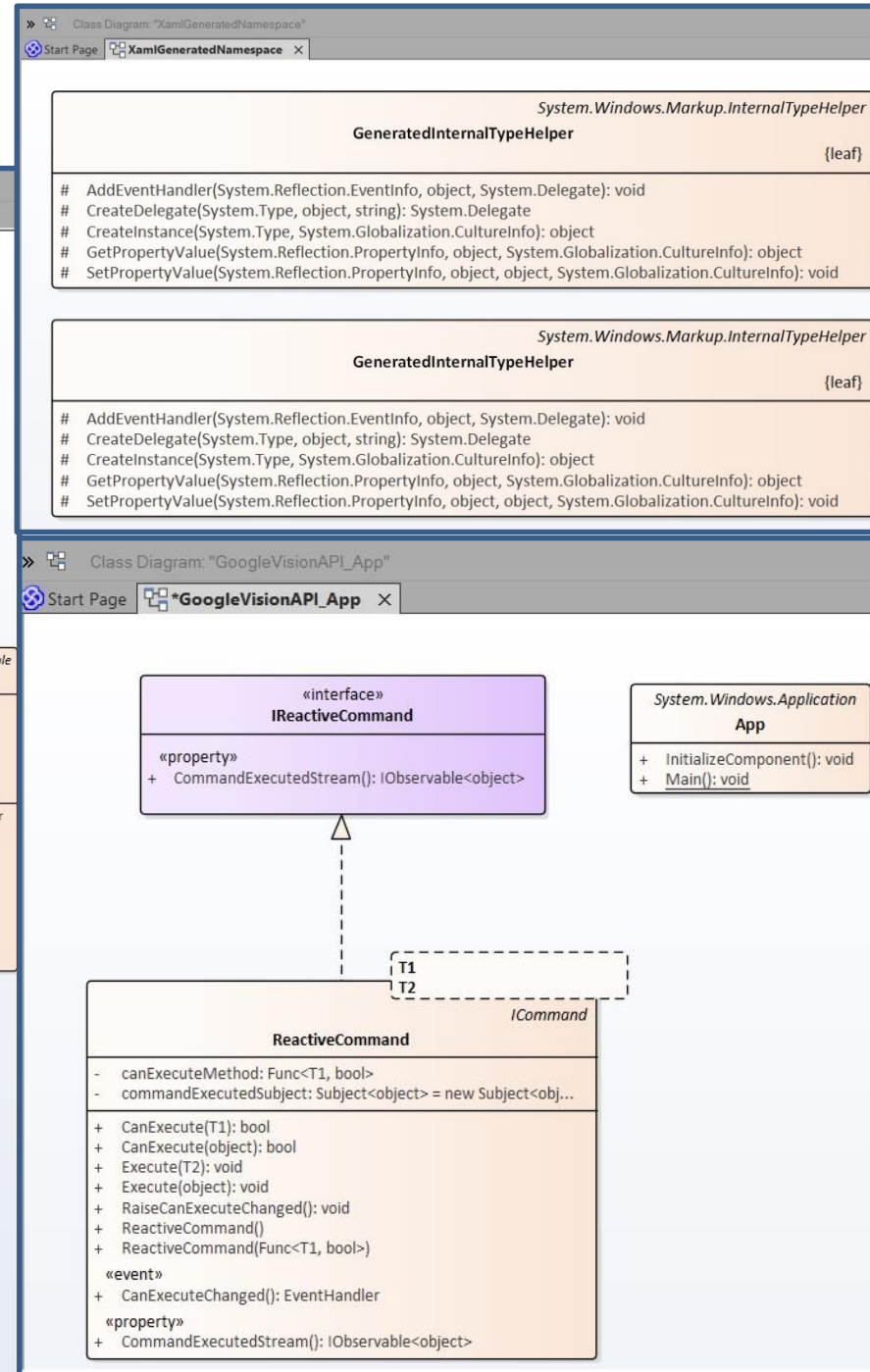
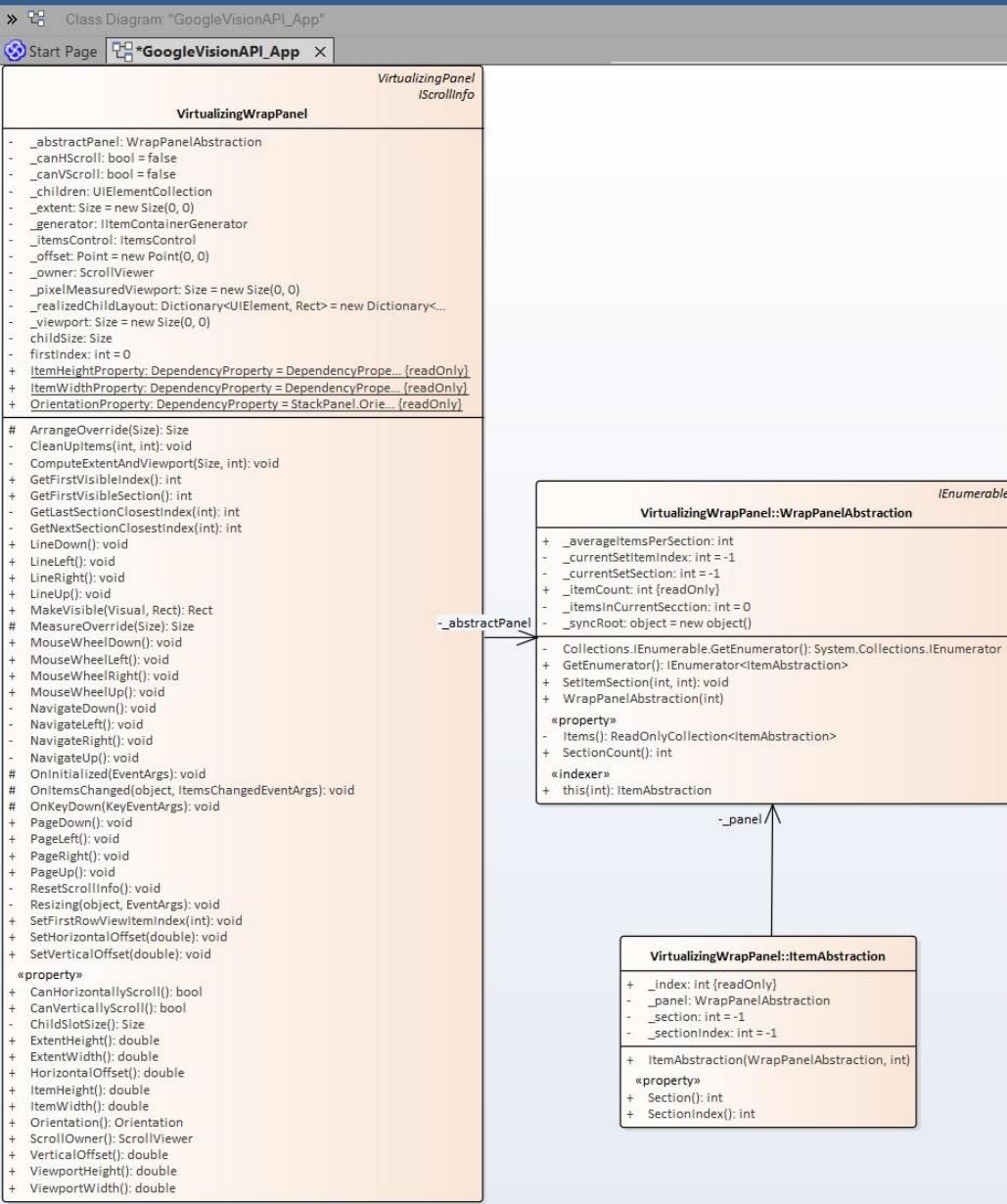
- Implementation - WPF (IDE = Visual Studio 2017)

# System Architecture (Class Diagram)

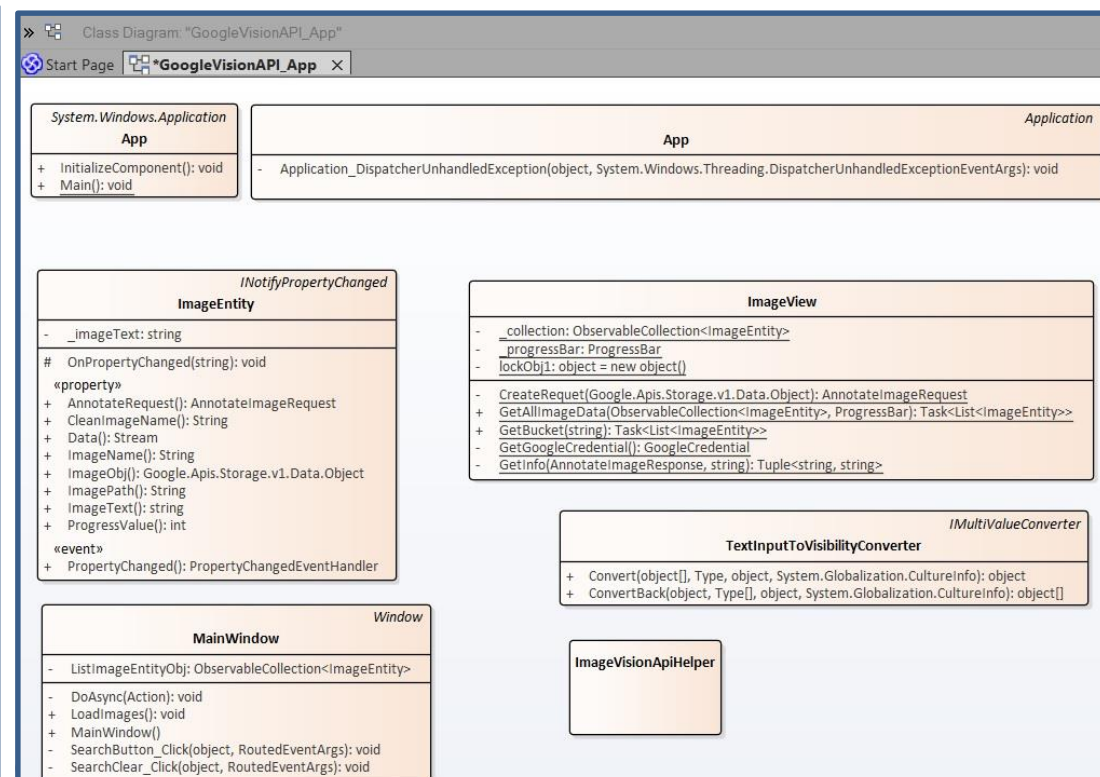
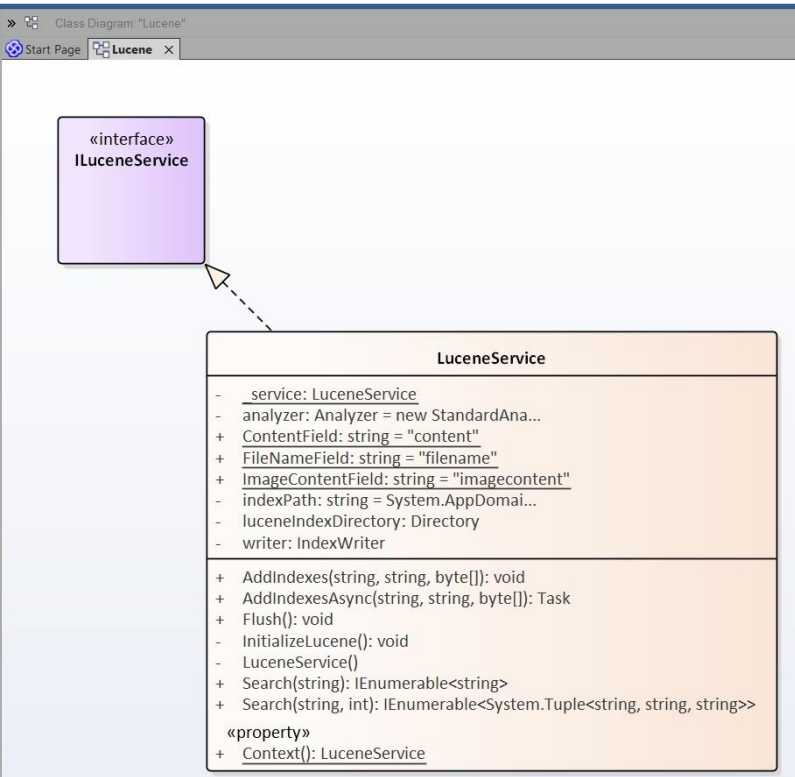
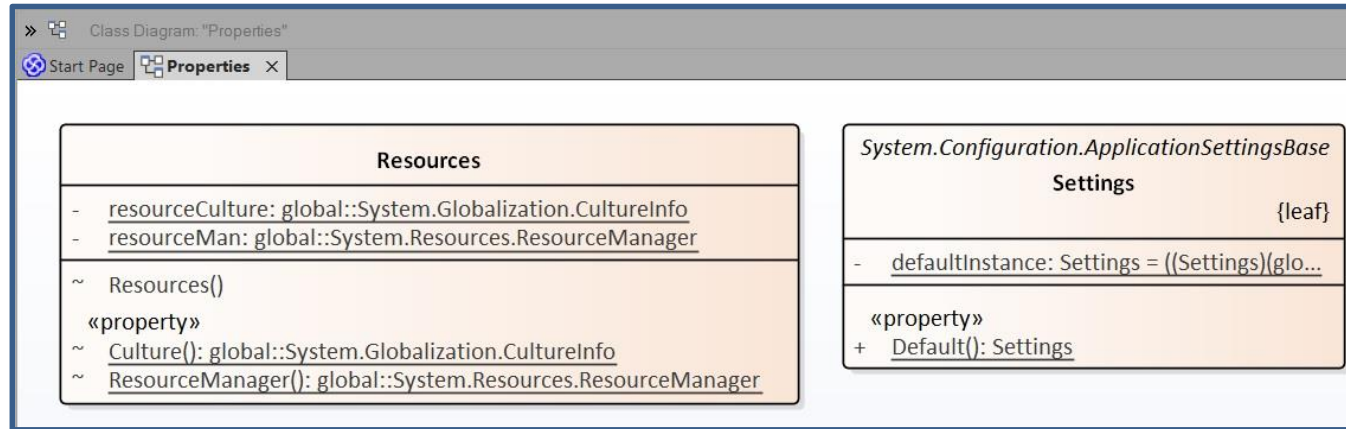




# System Architecture (Class Diagram)



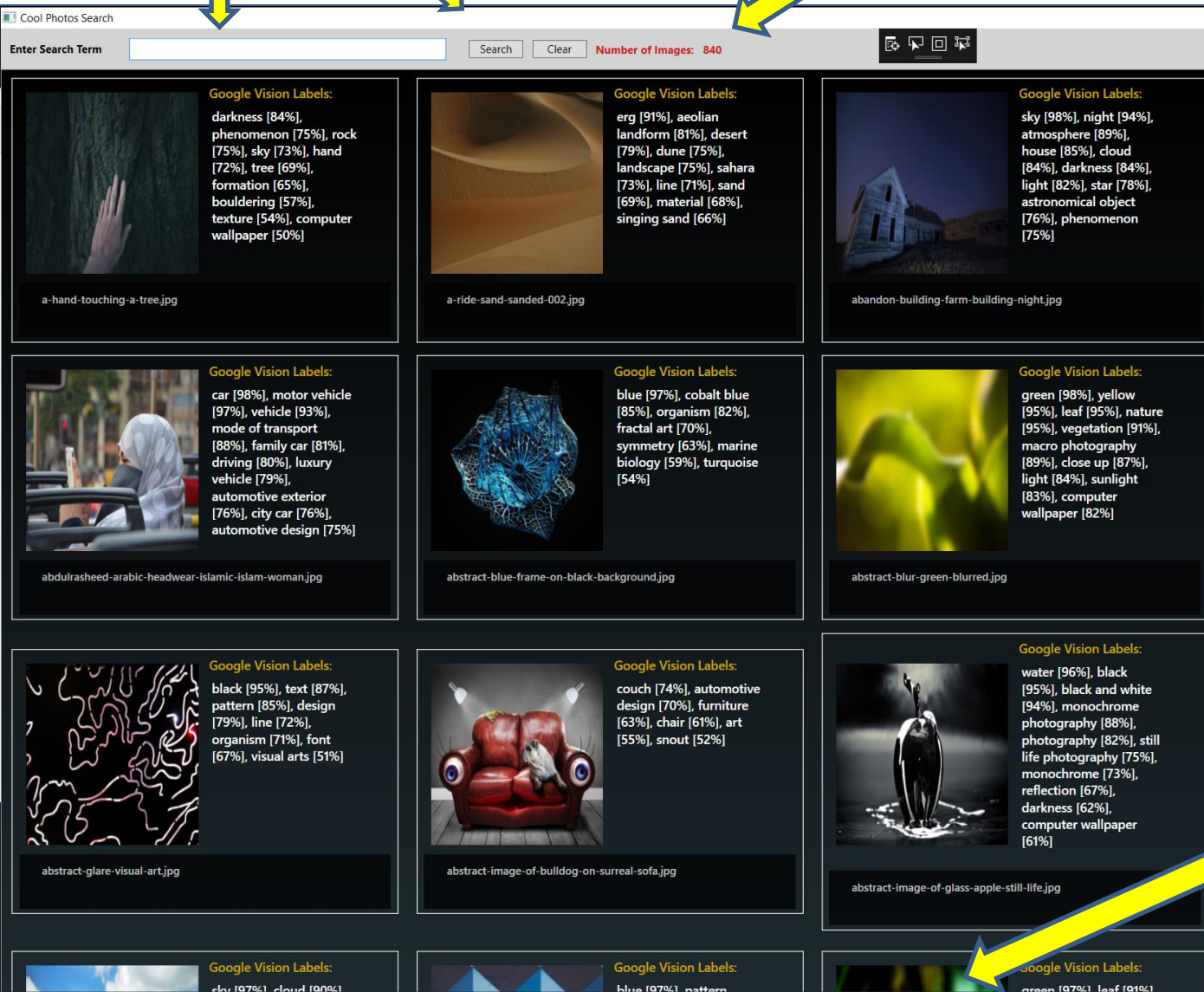
# System Architecture (Class Diagram)



# System snapshots – Main screen

**Search** will activate search based on the provided string query

Loading pictures from Google Cloud (default ordering is alphabetical, number of currently loaded pictures is shown on the top bar - 840 in the example)



Each picture shows relevant Google Vision labeling

Global load progress bar is shown at the bottom of the page (13% in the example)



# System snapshots – Search (sea)

Clear will bring you back to Main menu and  
Clear search query example

Search results for “sea” query - 96 hits in the example)


Cool Photos Search

Enter Search Term

Search


Clear

Number of Images: 96




Lucene ranking: [100%]  
Google Vision Labels:  
jellyfish [99%], cnidaria [97%], blue [97%], marine invertebrates [94%], invertebrate [89%], marine biology [86%], organism [82%], electric blue [65%], computer wallpaper [62%], special effects [60%]

blue-jellyfish-in-sea.jpg




Lucene ranking: [100%]  
Google Vision Labels:  
sea [95%], horizon [93%], sky [93%], shore [90%], ocean [87%], calm [86%], sunrise [83%], morning [77%], coast [75%], sunset [74%]

beachs-water-low-tide-001.jpg




Lucene ranking: [100%]  
Google Vision Labels:  
sky [96%], horizon [96%], afterglow [93%], sunset [91%], sunrise [89%], sun [87%], sea [84%], atmosphere [82%], dawn [79%], evening [79%]

birds-seagull-silhouette.jpg



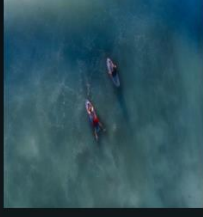
Lucene ranking: [100%]  
Google Vision Labels:  
horizon [94%], sky [94%], sunset [94%], sea [90%], afterglow [90%], sunrise [90%], pier [89%], cloud [83%], dusk [81%], evening [81%]

bridge-person-bridges-001.jpg



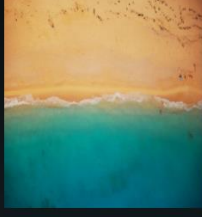
Lucene ranking: [95%]  
Google Vision Labels:  
blue [97%], nature [94%], coastal and oceanic landforms [94%], sea [91%], sea cave [90%], water [84%], azure [81%], sky [79%], ocean [72%], formation [66%]

beachs-cave-beach.jpg




Lucene ranking: [93%]  
Google Vision Labels:  
water [96%], sea [84%], wave [82%], atmosphere of earth [78%], geological phenomenon [77%], extreme sport [75%], sky [74%], wind wave [68%], adventure [63%], underwater [63%]

active-water-surfing.jpg



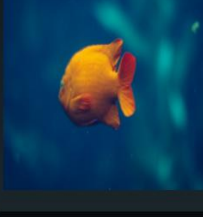
Lucene ranking: [93%]  
Google Vision Labels:  
water [95%], sea [92%], sky [91%], wave [80%], atmosphere [76%], calm [76%], ocean [75%], horizon [75%], underwater [64%], turquoise [53%]

aerial-view-of-coastline.jpg



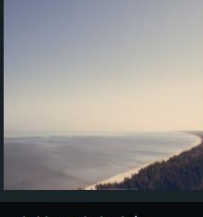
Lucene ranking: [93%]  
Google Vision Labels:  
fauna [93%], mammal [92%], harbor seal [89%], terrestrial animal [88%], wildlife [78%], snout [77%], organism [71%], whiskers [69%], otter [68%], mustelidae [65%]

animal-aquatic-brown-eye-eyes-face-mammal-marine.jpg




Lucene ranking: [93%]  
Google Vision Labels:  
fish [97%], fish [95%], marine biology [93%], underwater [90%], coral reef fish [87%], organism [82%], goldfish [81%], close up [80%], pomacentridae [78%], macro photography [68%]

aquarium-underwater-fish.jpg



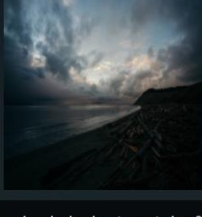
Lucene ranking: [93%]  
Google Vision Labels:  
sky [96%], horizon [95%], sea [88%], atmosphere of earth [81%], atmosphere [79%], calm [78%], morning [76%], shore [74%], daytime [73%], ocean [70%]

baltic-sea-in-latvia.jpg



Lucene ranking: [93%]  
Google Vision Labels:  
sky [95%], horizon [94%], sea [90%], shore [89%], sunrise [87%], wave [85%], sun [85%], sunset [84%], morning [81%], sunlight [79%]

beach-beachs-sunrise-002.jpg



Lucene ranking: [93%]  
Google Vision Labels:  
sky [96%], sea [96%], horizon [95%], body of water [93%], cloud [89%], ocean [88%], shore [87%], atmosphere [85%], dusk [83%], water [82%]

beach-cloud-water-watering-002.jpg

Lucene ranking: [93%]

Lucene ranking: [93%]

Lucene ranking: [93%]

Lucene ranking: [93%]


19%
















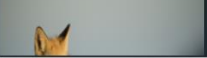
# System snapshots – Search (winter)

Search results for “winter” query - 77 hits in the example)

Cool Photos Search

Enter Search Term  Search Clear Number of Images: 77



 <p>Lucene ranking: [100%] Google Vision Labels: pumpkin [96%], cucurbita [90%], winter squash [88%], calabaza [87%], gourd [72%], squash [64%], vegetable [61%], produce [58%]</p> <p>autumn-november-pumpkin-fall-october-pumpkins.jpg</p>	 <p>Lucene ranking: [100%] Google Vision Labels: beauty [86%], girl [84%], photography [81%], black hair [77%], winter [77%], photo shoot [68%], long hair [60%], snow [58%]</p> <p>adults-snowing-snow.jpg</p>	 <p>Lucene ranking: [100%] Google Vision Labels: road [97%], fog [95%], lane [95%], mode of transport [87%], phenomenon [75%], road surface [74%], morning [73%], dust [70%], haze [69%], asphalt [68%]</p> <p>biking-bikes-bike.jpg</p>	 <p>Lucene ranking: [100%] Google Vision Labels: tree [91%], sky [91%], branch [89%], leaf [78%], twig [72%], pine family [68%], winter [55%], conifer [51%]</p> <p>branch-branches-tree.jpg</p>
 <p>Lucene ranking: [100%] Google Vision Labels: winter [87%], tree [86%], snow [82%], phenomenon [75%], geological phenomenon [74%], adventure [71%], sky [63%], water [61%], freezing [58%], mountain [58%]</p> <p>brim-woman-lady-003.jpg</p>	 <p>Lucene ranking: [97%] Google Vision Labels: snow [86%], winter [79%], freezing [69%], wood [60%], ice [55%]</p> <p>aerial-view-of-boardwalk-and-human-legs.jpg</p>	 <p>Lucene ranking: [97%] Google Vision Labels: ingredient [63%], flavor [63%], spice [62%]</p> <p>anice-and-cimmanon-with-red-ribbon-002.jpg</p>	 <p>Lucene ranking: [97%] Google Vision Labels: recreation [57%], girl [51%]</p> <p>boys-sneakers-boy-002.jpg</p>
 <p>Lucene ranking: [86%] Google Vision Labels: lighting [77%], candle [75%], hearth [72%], interior design [66%], light fixture [65%], heat [63%], fireplace [62%], lighting accessory [61%], table [55%], wood burning stove [53%]</p> <p>book-on-table-in-front-of-fireplace.jpg</p>	 <p>Lucene ranking: [86%] Google Vision Labels: beer bottle [87%], snow [85%], bottle [84%], winter [69%], water [65%], ice [62%], winter sport [54%]</p> <p>close-up-of-beer-bottles-in-snow-with-mountain-peak-in-background.jpg</p>	 <p>Lucene ranking: [85%] Google Vision Labels: wood [76%], font [62%], floor [61%], furniture [61%], product [59%], flooring [58%], table [56%], wood stain [54%], hardwood [52%]</p> <p>aerial-view-of-laptop-and-tv-remote-on-sofa.jpg</p>	 <p>Lucene ranking: [85%] Google Vision Labels: branch [98%], twig [90%], tree [89%], sky [83%], winter [65%], water [58%], plant stem [52%], freezing [51%], plant [50%]</p> <p>branch-branches-twigs-rain-drop.jpg</p>
 <p>Lucene ranking: [73%] Google Vision Labels: snow [98%], winter [98%]</p> <p>house-in-winter.jpg</p>	 <p>Lucene ranking: [73%] Google Vision Labels: sky [94%], water [94%]</p> <p>lake-in-winter.jpg</p>	 <p>Lucene ranking: [73%] Google Vision Labels: white [96%], water [96%]</p> <p>waterfall.jpg</p>	 <p>Lucene ranking: [73%] Google Vision Labels: fox [98%], wildlife [96%]</p> <p>fox.jpg</p>

# Installation options

## Link to Installer Download (**Windows only!**)

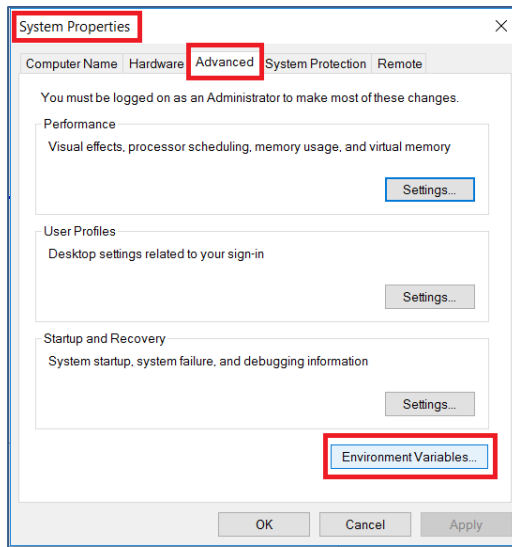
- <https://www.dropbox.com/s/ef38sas1o7vxji8/CoolPhotoSearchSetup.msi?dl=0>

## Link to GitHub (Source Files)

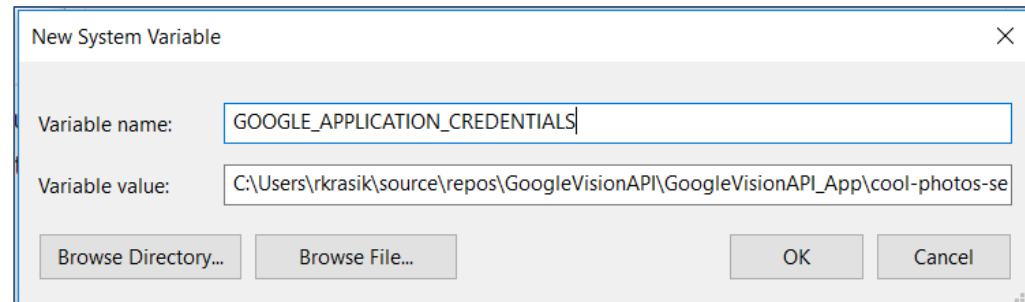
- [https://github.com/rkrasik7/cs\\_410\\_final\\_project\\_photos\\_search](https://github.com/rkrasik7/cs_410_final_project_photos_search)
- In order to compile and run in **Visual Studio 2017** - there is need to **uninstall the Installer** (in case it was installed) and define relevant System Environment variables



**STEP 1**



**STEP 2**



**Variable name:** GOOGLE\_APPLICATION\_CREDENTIALS  
**Variable value (e.g. depends on the Git directory):**  
C:\Users\rkrasik\source\repos\GoogleVisionAPI\Google  
VisionAPI\_App\cool-photos-search-57852b03daf7.json

**STEP 3**



# Key learnings

- Performance is challenging when you are dealing with pictures - need to consider resizing, optimizations, multithreading etc.
- Pictures validation is essential, you might face the same picture but in a different quality
- Nothing is for free - my 300\$ Google Cloud Platform budget ran out within 2 weeks☹️
- The Google Vision and Lucene APIs are quite rich, yet sometime not as comprehensive with regards documentation...

# Further extension

- Add additional source inputs
  - User laptop / USB drive / Google Drive / Google Photos / Instagram / Facebook / ...
- Add complex searches
  - AND / OR / IN operators support
- Add operations for search results
  - Save picture for single picture
  - Select/multi-select pictures and then “Save pictures”
  - Save query
- Further performance boost
- User Experience and Usability enhancements





**This is  
THE END  
and  
Thank you  
For watching**