「2019 GLOBE Program」 Report

See The Clouds with AI

Yebong Middle School

I Independent Inquiry

Task Name	See The Clouds with AI
Category	Atmospher
Protocol	cloud observation, Temperature, Humidity
Exploration results summary	[Exploration theory] Open CV Learning Deep Learning [Data collection] Collecting images from the atmosphere using webcam [Data analysis] Image Analysis and Visualization of Cloud and Atmospheric Sections

I General outline

❑ purpose of exploration

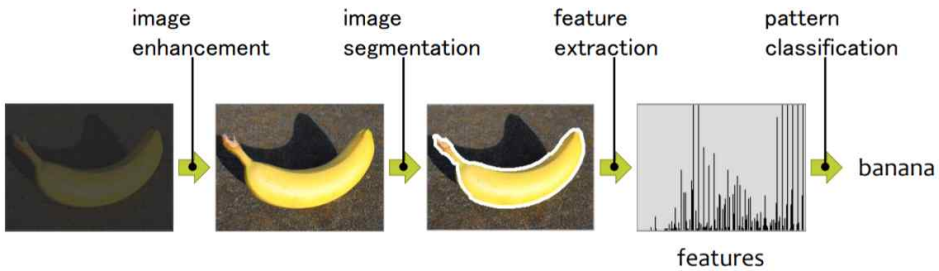
○ Using Open CV's deep learning technique, which is an open source computer vision library, we want to identify the correlation between air information and pollution through analysis of atmospheric (cloud and life) images.

❑ method of exploration

1. [Exploration theory] Open CV Learning Deep Learning

○ Learning the Pattern Processing Process of Digital Images

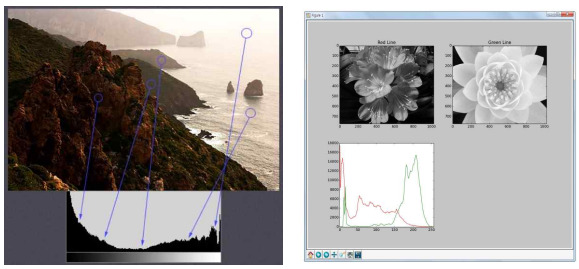
- Categorize the entered object (patterns) according to the given algorithm
- Pattern Recognition Procedure



(Sources : http://j.mp/303eLX8)

○ Learn Pixel Based Image Histogram

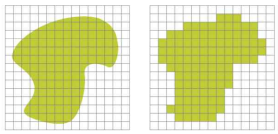
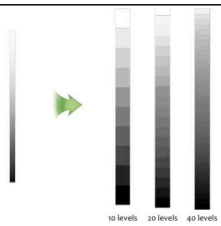
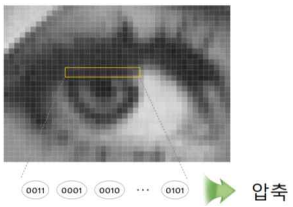
- Histogram can analyze the overall brightness distribution and saturation of an image in a graphical manner.



(출처 : Cambridgeincolor in Color)

○ Algorithm Identification Through Sampling

- Process : Sampling > Quantification > Coding

		
Sampling	Quantification	Coding

(Sources : http://j.mp/305muUE)

2. [Data collection] Collecting images from the atmosphere using webcam

○ Fixed webcam and sensor installation around school

- Webcam : Commercial webcam purchase (Logitec c170)
- Control : raspberry pi
- Sensor: Aduino (temperature, humidity, fine dust, air pressure)

				
webcam	raspberry pi	Sensor of Aduino		

○ Gathering image (BMP) data and taking atmospheric measurements through webcam

○ Building Big Data for Image Data

3. [Data analysis] Image Analysis and Visualization of Cloud and Atmospheric Sections

○ Pixel analysis and sampling of atmospheric image

○ Image analysis using Python algorithm

○ Correlation analysis with atmospheric information (temperature, humidity, fine dust, etc.)

II Exploration results

❑ results

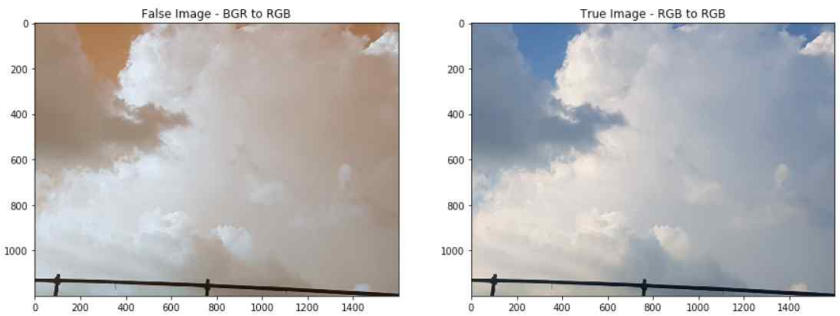
○ The study of open cv-algorithm based on Python and image processing

○ Processing of cloud shape and open cv image linked to weather information

○ Automated construction of cloud-shaped photography using raspberry pie

○ Creating and exterminating clouds by continuously regenerating the process of changing the shape of clouds

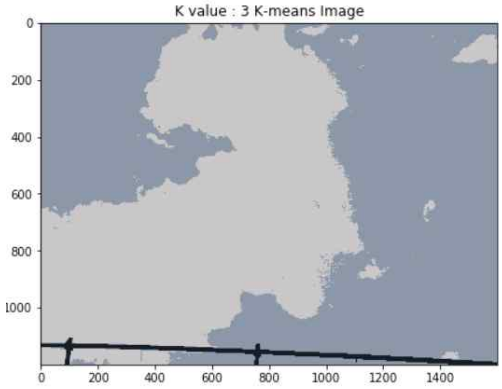
[Step 1] Analyze RGB and BGR images

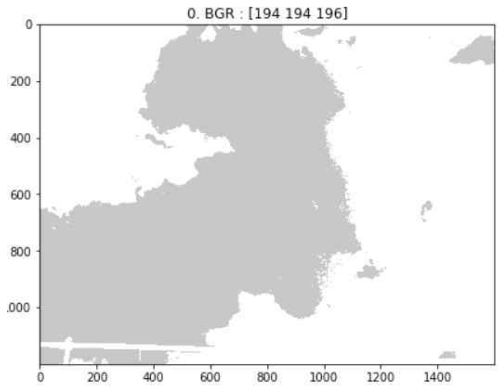


[Step 2] Color Quantization

A technique used to reduce the number of colors used in images, using the K-Means algorithm. The K-Means clustering algorithm calculates a good cluster-centric position based on internal calculations by setting the user-specified number of clusters (k_value). In other words, the location of the BGR color code is calculated and the appropriate center value (center)

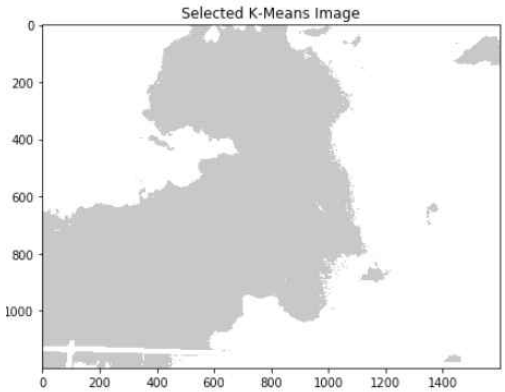
is selected.

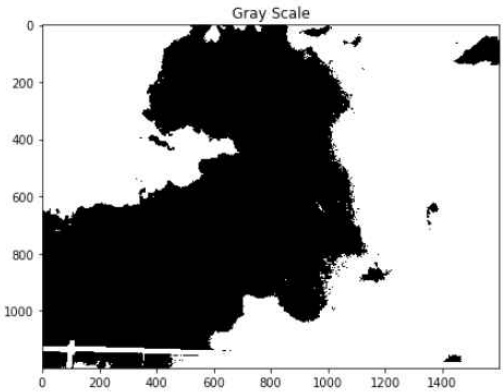




[Step 3] Transformation of black and white images (Transition GrayScale)

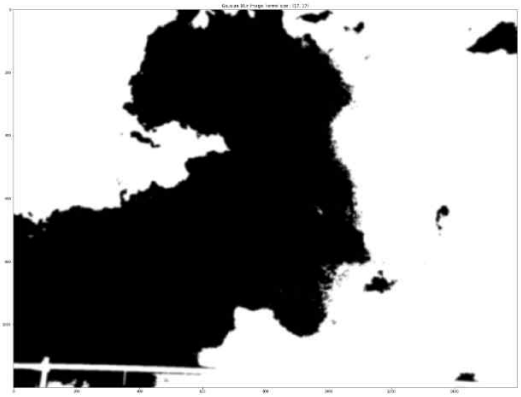
Select the resulting image of the K-means algorithm and convert it to a black-and-white image. The advantage of converting to black-and-white images is that some of OpenCV's algorithms take place on one channel (typically in black and white), rather than on three-channel colors such as BGR, saving memory and increasing computational speed.(Relatively, it also has the effect of reducing noise.)



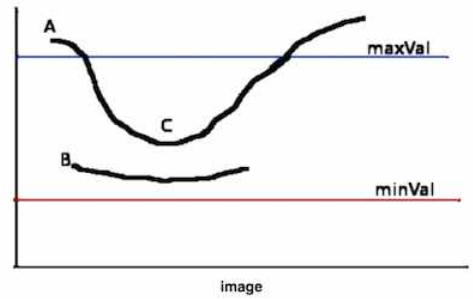


[Step 4] Gaussian Blur

Image Smoothin or Blur is intended to remove noise present in the image. The larger the kernel size used in the Gaussian Blur, the stronger the blur becomes. (Kernel size only available in odd numbers)



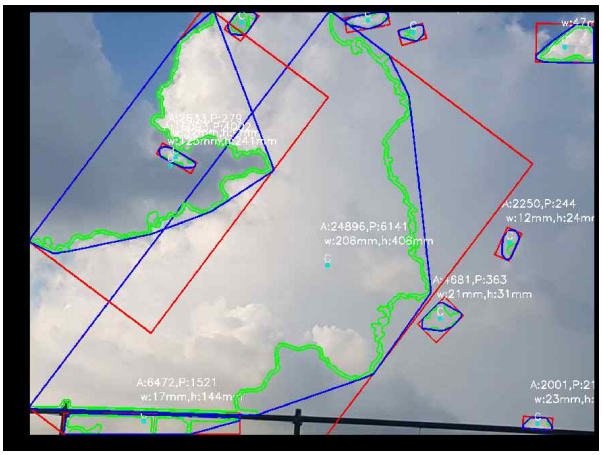
[Step 5] Boundary Calculation (Transition Canny)



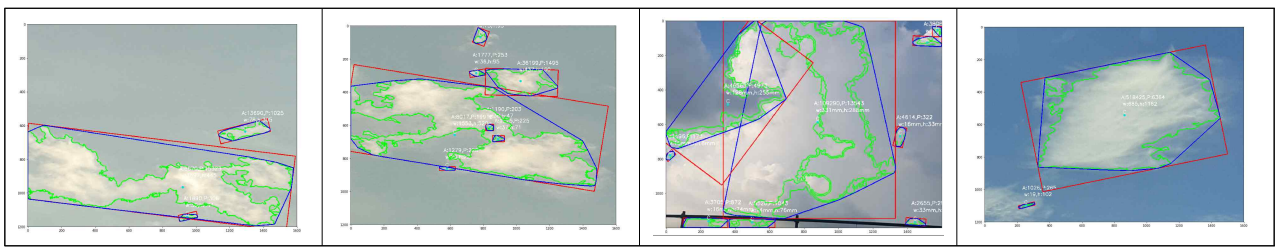
[Step 6] Expanding (Transition Dilate)

[Step 7] Arrest (Transition Erode)

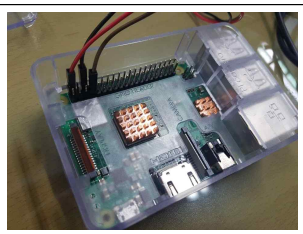
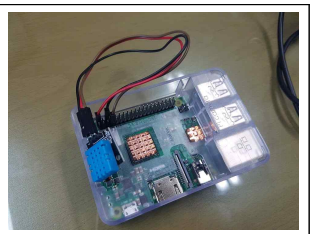
[Step 8] Find Out Outline (Find Contours)



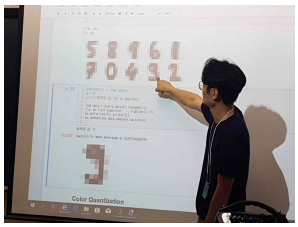
○ Student output (Cloud photography and image processing once a week)



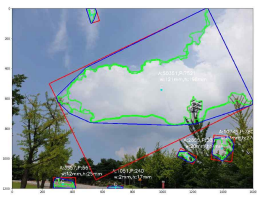
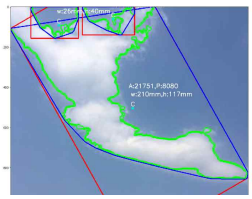
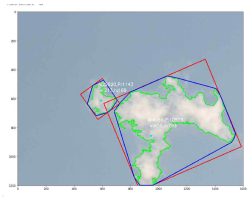
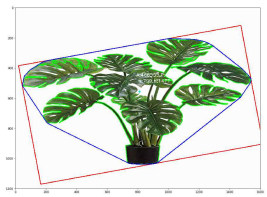
○ Establishment of automated cloud shooting system (Raspberry pi board)

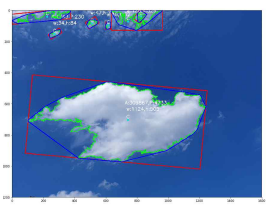
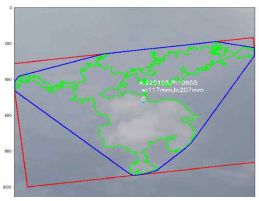
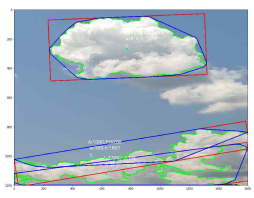
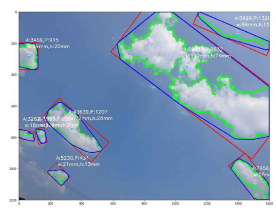
			
WebCam	fine dust sensor	raspberry pi	Temperature and humidity sensor

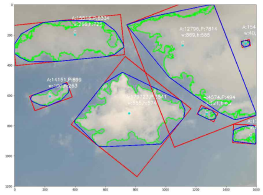
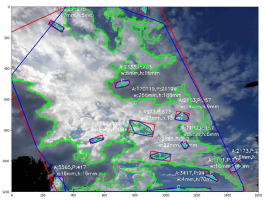
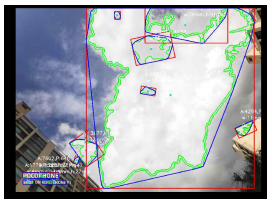
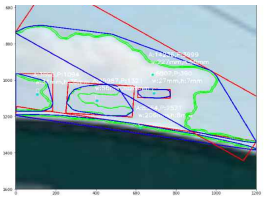
○ Open CV(AI) Education Workshop and Image Processing Activity

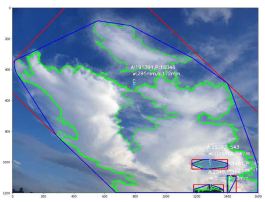
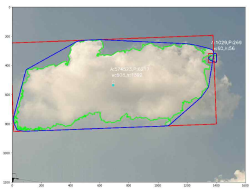
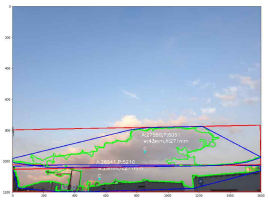
			
Python algorithm	cloud boundary treatment	Quantifying images	open cv practice

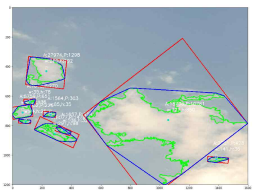
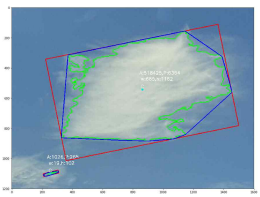
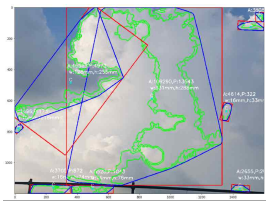
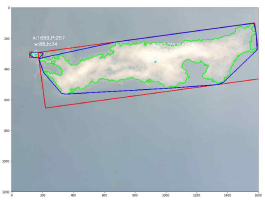
❑ 탐구 일지

Date	8/4	8/3	8/2	7/30
Temperature	34	26.4	27	26
Humidity	30	96	65	75
Image processing				

Date	8/12	8/8	8/7	8/6
Temperature	34	31.9	27	36
Humidity	50	55	35	45
Image processing				

Date	8/16	8/15	8/14	8/13
Temperature	29	34	34	28.9
Humidity	65	52	65	78
Image processing				

Date	8/24	8/23	8/19	8/18
Temperature	26	31	31	27
Humidity	57	55	50	84
Image processing				

Date	9/23	9/16	9/10	8/25
Temperature	23	29	25	28
Humidity	55%	60%	63	45
Image processing				

Ⅲ Performance and Planning

❑ Performance from GLOBE activities

- ○ Image analysis of cloud shape using artificial intelligence algorithm
- ○ Image processing by recognizing the boundary between background (sky) and cloud
- ○ Establishment of an Interval Automatic Photography System using Raspberry Pi

❑ Planning

- ○ Comparative analysis of the automatic image, temperature and humidity measurements of interval (30 minutes)
- ○ Automatic cloud imaging image data collection and continuous playback
- ○ Documentary and promotional video production of GLOBE activities

II Common Inquiry

❑ Topic : Exploring the Atmospheric Phenomenon on the Korean Peninsula through the Observation of Clouds

❑ Journal of inquiry

Date	6/10	6/11	6/12	6/14	6/17
Type of Cloud	nimbostratus	cumulus	cumulus	cumulus	cumulus
Note	moist and cloudy	Cloudy and clear	Clouds are low and Clear	Cloudy	scattered clouds
Date	6/18	6/19	6/20	6/21	6/24
Type of Cloud	stratus	stratus	nimbostratus	stratus	cumulus
Note	light clouds and clouds	thick clouds and clouds	Cloudy and clear	Cloudy and cloudy	Cloudy and clear
Date	6/25	6/28	7/1	7/3	7/5
Type of Cloud	cirrus	none	stratocumulus	none	cumulus
Note	the absence of a cloud	Cloudless and cloudy	Cloudy and cloudy	cloudy	Cloudy and clear
Date	7/8	7/9	7/10	7/12	7/17
Type of Cloud	cirrus	cumulus	cirrostratus	cirrostratus	none
Note	Cloudy and cloudy	Cloudy and clear	Cloudy and cloudy	Cloudy and clear	cloudy
Date	7/18	7/26	7/29	8/1	8/2
Type of Cloud	stratus	stratocumulus	stratocumulus	stratocumulus	cumulus
Note	Cloudy and clear	Cloudy	Dry	Cloudy silence	Cloudy and dry
Date	8/6	8/9	8/10	8/12	8/13

Type of Cloud	cumulus	cumulus	cumulus	stratocumulus	cumulus
Note	a feather cloud	Cloudy	Cloudy silence	Cloudy	Cloudy
Date	8/19	8/21	8/22	8/27	9/2
Type of Cloud	cumulus	cirrostratus	cumulus	cumulus	stratus
Note	Dry	cloudy	Cloudy and clear		
Date	9/3	9/4	9/17	9/18	9/23
Type of Cloud	nimbostratus	altocumulus	cumulus	none	cirrocumulus
Note		cloudy		Cloudless and clear	clear
Date	9/24	10/10	11/15	11/18	11/22
Type of Cloud	none	cumulonimbus	stratus	cumulus	none
Note		cloudy		high humidity	
Date	11/25	11/27	11/28		
Type of Cloud	cumulus	stratus	cirrocumulus		
Note					

❑ Total Observations: 48 times

❑ Data entry count : 48 times

SCHOOL DATA SITES

☑ Include citizen science sites

Site Name	Investigation Area	# Observations	Created	Last Used
52SCG422613	Atmosphere	1	08/01/2019	08/01/2019
52SCG428624	Atmosphere	8	06/26/2019	11/27/2019
52SCG429617	Atmosphere	6	07/29/2019	11/22/2019
52SCG429618	Atmosphere	4	07/26/2019	11/15/2019
52SCG429622	Atmosphere	1	07/08/2019	07/05/2019

Site Name	Investigation Area	# Observations	Created	Last Used
52SCG429623	Atmosphere	12	06/10/2019	10/10/2019
52SCG429624	Atmosphere	12	06/26/2019	09/24/2019
52SCG430618	Atmosphere	2	08/06/2019	08/13/2019
52SCG430619	Atmosphere	1	08/09/2019	08/09/2019
52SCG430625	Atmosphere	1	08/19/2019	08/19/2019

❑ Frequency by Cloud

Cloud type	stratus	nimbostratus	cirrostratus	cumulus	cirrocumulus
number of times	6	2	3	18	3

❑ special note

- ○ In many cases, even clouds of the same type are not certain of type breaking because of different detailed classification standards
- ○ Although continuous observation was possible if observations were organized differently for each day of the week, I have the idea that the consistency of the observation criteria may be different.

❑ Performance

- ○ Checking and exploring types of clouds through cloud observation
- ○ Identifying the distribution of seasonal clouds through the data accumulation of cloud pictures
- ○ Become more familiar with clouds and recognize their value as data generated by nature

III Epilogue

성명	후기
Jeon Gun-woo	**GLOBE Project Cloud Observation Thoughts** The GLOBE project, which we started with hope at first, is already over. I feel sorry for not working hard. I wasn't really interested in clouds before the original GLOBE project and didn't even know what clouds meant. But with this GLOBE project, we have studied exactly how clouds form, the exact type of clouds and when they occur, and most of the information about clouds seems to be enough to explain to friends in detail. And I was able to observe the clouds of the day that I took charge of and feel the fun that I didn't usually feel and it was a rewarding time. And the most amazing thing was that clouds could represent the climate and weather conditions of our country. That's why it was a precious time for NASA to feel the reason for observing and transmitting clouds, which they didn't understand at first. In the future, I want to go into the clouds a little more and become an expert. **GLOBE project image processing Thoughts** I learned the important fact that it is important to make an algorithm while learning the process of image processing, a task that did not work well at first, but also to use well. It is very surprising that the task of picking out only the objects we want from the paintings with different objects is easy for us humans, but the computer has to use a very long program to find the objects we want. The K-MEANS algorithm is also used not only in the process of image processing, but also in the proper classification of various big data... I felt a new feeling. In particular, I was impressed with the last piece of find contents I did (e.g., erosion, expansion, Gaussian blue, etc.) and it was very impressive and interesting to see that the work I did (e.g. erosion, expansion, Gaussian blue, etc.) resulted in the fruit of the find sour. I want to learn various programming languages such as C language as well as Python that I studied this time.
Hwang Dong-won	Hello, I am Hwang Dong Won from Yebong Middle School who participated in the GLOBE program. I had a trial and error in installing a program called OPENCV from the beginning, and I had three computers installed and repeated erasing, and eventually succeeded in installing it, and I had a great sense of accomplishment. And it was a good experience to use Python for the first time. When I was dealing with artificial intelligence this time, I realized that artificial intelligence, which had been known to be difficult and complicated until now, is actually very simple and not that difficult to deal with. And it was so amazing and new that I could process the cloud pictures that I took or posted on the Internet. I thought it was so amazing that I did image processing of all the pictures that came to mind three times a week. As a result, I image toys, puppies, things, toys, logos, etc. and as a result, I image close to 100 pictures. It was a great experience, and most of all, it was so much fun to think about which photo

	to Thank you very much for giving me such a good experience.
No Min Ji	When I told my friends I was observing the clouds, they all looked at me strangely. If I hadn't done a project like this, I would have thought the same way as my friends would have thought, 'What are you going to do with the cloud?' To be honest, it would be a lie to say that it wasn't bothersome to observe the clouds once a week. When I forgot to do it, I would observe the clouds even during lunch time. Especially I was more difficult than other cloud watchers. Cloud observations are made during recess after the third period. The day of the week I was in charge of was Tuesday, but of all things I had to do was music, where the third class was science and the fourth class was mobile. As soon as the third period was over, I went to the student department on the 4th floor to get my phone from the teacher and came back to the 3rd floor. I borrowed Kyungcheol's hotspot from the natural science department, went to the 1st floor to observe the clouds, returned the hotspot to the 3rd floor, returned the 4th floor, handed in my cell phone, and went to the 5th floor after collecting music files from the classroom. Sometimes I get in trouble for being late for class, but I felt really unfair. And I regretted it. Why did I say I would do it on Tuesday? I would never choose this day if I went back to the past. Still, observing clouds was a refreshing experience in itself. In the first class, we had time to study clouds and it was amazing that these data we observed were used by NASA. Last time I got a mail from NASA, I think I was proud. If I have another chance like this, I will do it again.
Lee Soo-hyun	I worked on the cloud observation project with Kyung-chul and other friends for a year. On the first meeting day, we had time to study about clouds. It was difficult but fun to interpret the fingerprints in English together. I think it would have been better if we could meet regularly after the meeting to share the impressive results of each other's view of the clouds, and the difficulties we experienced in the process. Above all, what I regretted was my attitude. I don't think I've participated in cloud observation in a year. When we first decided to do the project together, there was a vague fantasy about clouds. When I opened up the results later, I thought it would be great if something came out (not just by observing it). So I think I was a little tired because I only watched the clouds. I think we should have started with a deeper conversation about the meaning of 'observation' and 'why'. But in conclusion, I blame myself the most for not being sincere. I should have thought about the meaning and reason of this activity and asked my teacher, but I just felt lazy. So I am very sorry and self-reflection. One of the good things about the cloud is that I was able to feel comfortable looking up at the sky in my busy daily life. For some reason, I prefer clouds.