Sensing Technologies and Mathematics for Geomatics
GEO1001.2020
MSc Geomatics
Delft University of Technology

Homework 1

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After Lesson 01.

1. *Compute mean statistics (mean, variance and standard deviation for each of the sensors variables), what do you observe from the results?.*

   Table 1 gives us information about statistics data from each sensors variables. We can see the Mean, Variance and Standard Deviation (std) from sensor A, B, D, and E. If we see from the Table 1, there aren't much differences in Mean value of each variable. For instance, in wind speed variable, sensor D has the highest value with 1.58 m/s and sensor E has the lowest value with 0.59 m/s therefore the difference of the highest and the lowest mean is less than 1 m/s (see Table 2). We can say that the central tendency of wind speed variable is relatively close to each sensor therefore the wind speed value in each sensor is relatively close too.

   Table 2 shows the highest and lowest Mean, variance and Standard Deviation Value. If we take a look at the table, we can see that sensor D has the highest mean of Barometric Pressure but the lowest mean of standard deviation and sensor E is the opposite. Therefore we can say that the Barometric Pressure value of sensor D is not as widely spread as sensor E because Barometric Pressure value in sensor D is tend to be close to its central tendency. We can make another observation by checking both tabel 1 and table 2.

Variable	sensor A			sensor B			sensor C			sensor D			sensor E		
	mean	variance	std	mean	variance	std	mean	variance	std	mean	variance	std	mean	variance	std
Wind speed [m/s]	1.290306947	1.251154492	1.118550174	1.242124394	1.301501586	1.140833724	1.371463217	1.430920058	1.196210708	1.581649151	1.73981677	1.319021141	0.596242424	0.51122678	0.715001245
Wind direction [deg]	209.4063005	10108.94031	100.5432261	183.4123586	9977.21777	99.8860239	183.5889248	7703.363096	87.7688048	198.3265966	8133.890057	90.18808157	223.9563636	9308.28508	96.47945418
Crosswind Speed [m/s]	0.964943457	0.926592764	0.962596886	0.835621971	0.878585108	0.937328709	0.963298302	1.042574802	1.021065523	1.210509297	1.451502935	1.204783356	0.438505051	0.315941984	0.562087168
Headwind Speed [m/s]	0.163529887	1.034940101	1.017320058	-0.129806139	1.256719316	1.121034931	-0.262894099	1.271732179	1.127711035	-0.300565885	1.232502712	1.110181387	0.194949495	0.319073108	0.564865566
Temperature [deg C]	17.96910339	15.86426926	3.982997522	18.06542811	16.62906693	4.077875296	17.91313662	16.10453824	4.013046005	17.99636217	16.10559129	4.013177206	18.35393939	19.04313221	4.363843743
Globe Temperature [deg C]	21.54458805	68.19135252	8.257805551	21.79943457	66.04931685	8.12707308	21.58738884	67.9413047	8.242651558	21.35929669	61.2022528	7.82318687	21.17616162	63.21550264	7.950817734
Wind chill [deg C]	17.83820679	16.26444672	4.032920371	17.94592084	17.03582578	4.127447853	17.77299919	16.54112266	4.067077902	17.83536783	16.55685213	4.069011198	18.2940202	19.13706204	4.374592786
Relative humidity [%]	78.18477383	376.010059	19.3909788	77.87831179	408.6230082	20.21442575	77.96285368	374.622643	19.35517096	77.94203719	389.8560405	19.74477249	76.79305051	406.4944626	20.16170783
Heat Stress Index [deg C]	17.89959612	14.99684832	3.872576445	18.0042811	15.43915742	3.929269324	17.82825384	15.35625356	3.918705598	17.9216249	15.11764378	3.88814143	18.28642424	18.47524004	4.298283383
Dew Point [deg C]	13.55387722	9.72347183	3.118248199	13.53085622	9.636518216	3.104274185	13.45812449	10.08414949	3.17555499	13.50860954	10.07188298	3.173623006	13.55878788	9.422585434	3.069623012
Psychro Wet Bulb Temperature [deg C]	15.2707189	6.944027119	2.6351522	15.29551696	6.770262723	2.601972852	15.19664511	7.239313447	2.690597229	15.26018593	7.044402877	2.654129401	15.40666667	6.997445432	2.645268499
Station pressure [mb]	1016.168255	38.47126661	6.202520988	1016.657027	36.84193443	6.069755714	1016.689329	37.69149142	6.139339657	1016.728011	34.98778359	5.915047218	1016.166101	38.93991345	6.24018537
Barometric pressure [mb]	1016.128433	38.46795084	6.20225369	1016.616478	36.82886775	6.068679243	1016.6519	37.67562316	6.138047178	1016.688884	34.95232686	5.912049294	1016.127798	38.93517684	6.239805833
Altitude [m]	-25.98707593	2663.641045	51.61047418	-30.05815832	2545.708131	50.45501096	-30.33872272	2608.534634	51.07381554	-30.65319321	2419.723591	49.19068602	-25.96121212	2692.353386	51.88789248
Density Altitude [m]	137.3166397	26510.04435	162.819054	135.5807754	26863.31024	163.9003058	129.6228779	26986.60297	164.2759963	132.4110752	26516.12573	162.8377282	150.84	29714.9275	172.380183
NA Wet Bulb Tempterature [deg C]	15.98154281	10.01210768	3.164191473	15.99680937	9.809254462	3.131972934	15.93423605	10.4802791	3.237325918	15.91564268	9.98743414	3.160290199	15.93688889	9.432183526	3.071186013
WBGT [deg C]	17.25432149	16.13525808	4.016871679	17.32197092	15.83535547	3.979366214	17.22502021	16.54674535	4.067769088	17.17679871	15.5071849	3.937916314	17.18553535	15.48987153	3.93571741
TWL [w/m^2]	301.3929321	814.7665642	28.5441161	299.4516963	790.0692214	28.10817001	301.8997575	766.5335139	27.68634165	305.2545675	616.0098073	24.81954486	284.1153131	1289.913383	35.91536416

Table 1: Value of Mean, Variance and Standard Deviation of Each Variable in Sensor A, B, C, D and E

Sensor's Variable	Mean Value				Varian Value				Standard Deviation Value			
	Max	Sensor	Min	Sensor	Max	Sensor	Min	Sensor	Max	Sensor	Min	Sensor
Wind speed [m/s]	1.581649151	sensor D	0.596242424	sensor E	1.73981677	sensor D	0.51122678	sensor E	1.319021141	sensor D	0.715001245	sensor E
Wind direction [deg]	223.9563636	sensor E	183.4123586	sensor C	10108.94031	sensor E	7703.363096	sensor C	100.5432261	sensor E	87.7688048	sensor C
Crosswind Speed [m/s]	1.210509297	sensor D	0.438505051	sensor E	1.451502935	sensor D	0.315941984	sensor E	1.204783356	sensor D	0.562087168	sensor E
Headwind Speed [m/s]	0.194949495	sensor E	-0.300565885	sensor D	1.271732179	sensor C	0.319073108	sensor E	1.127711035	sensor C	0.564865566	sensor E
Temperature [deg C]	18.35393939	sensor E	17.91313662	sensor C	19.04313221	sensor E	15.86426926	sensor A	4.363843743	sensor E	3.982997522	sensor A
Globe Temperature [deg C]	21.79943457	sensor E	21.17616162	sensor E	68.19135252	sensor E	61.2022528	sensor D	8.257805551	sensor E	7.82318687	sensor D
Wind chill [deg C]	18.2940202	sensor E	17.77299919	sensor C	19.13706204	sensor E	16.26444672	sensor A	4.374592786	sensor E	4.032920371	sensor A
Relative humidity [%]	78.18477383	sensor E	76.79305051	sensor C	408.6230082	sensor E	374.622643	sensor C	20.21442575	sensor E	19.35517096	sensor C
Heat Stress Index [deg C]	18.28642424	sensor E	17.82825384	sensor C	18.47524004	sensor E	14.99684832	sensor A	4.298283383	sensor E	3.872576445	sensor A
Dew Point [deg C]	13.55878788	sensor E	13.45812449	sensor C	10.08414949	sensor C	9.422585434	sensor E	3.17555499	sensor C	3.069623012	sensor E
Psychro Wet Bulb Temperature [deg C]	15.40666667	sensor E	15.19664511	sensor C	7.239313447	sensor C	6.770262723	sensor B	2.690597229	sensor C	2.601972852	sensor B
Station pressure [mb]	1016.728011	sensor D	1016.166101	sensor E	38.93991345	sensor E	34.98778359	sensor D	6.24018537	sensor E	5.915047218	sensor D
Barometric pressure [mb]	1016.688884	sensor D	1016.127798	sensor E	38.93517684	sensor E	34.95232686	sensor D	6.239805833	sensor E	5.912049294	sensor D
Altitude [m]	-25.96121212	sensor E	-30.65319321	sensor D	2692.353386	sensor E	2419.723591	sensor D	51.88789248	sensor E	49.19068602	sensor D
Density Altitude [m]	150.84	sensor E	129.6228779	sensor C	29714.9275	sensor E	26510.04435	sensor A	172.380183	sensor E	162.819054	sensor A
NA Wet Bulb Tempterature [deg C]	15.99680937	sensor E	15.91564268	sensor D	10.4802791	sensor C	9.432183526	sensor D	3.237325918	sensor C	3.071186013	sensor E
WBGT [deg C]	17.32197092	sensor E	17.17679871	sensor D	16.54674535	sensor C	15.48987153	sensor E	4.067769088	sensor C	3.93571741	sensor E
TWL [w/m^2]	305.2545675	sensor D	284.1153131	sensor E	1289.913383	sensor E	616.0098073	sensor D	35.91536416	sensor E	24.81954486	sensor D

Table 2: The Highest and Lowest Value of Mean, Variance and Standard Deviation

2. *Create 1 plot that contains histograms for the 5 sensors Temperature values. Compare histograms with 5 and 50 bins, why is the number of bins important?*

   Figure 1 to Figure 5 show us the differences between 5 bin (on the left side) and 50 bin (on the right side) in temperature variable. From the figure, we can conclude that the more bin we have the more the data represent. If we see the histogram with 5 bin, the data grows up and down simultaneously but it is totally different if we see the histogram with 50 bin where the data is represent as it is.

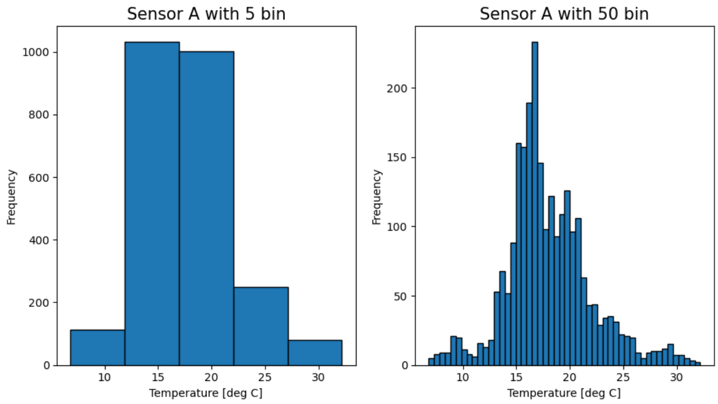

Figure 1: bin comparison between temperature variable in sensor A

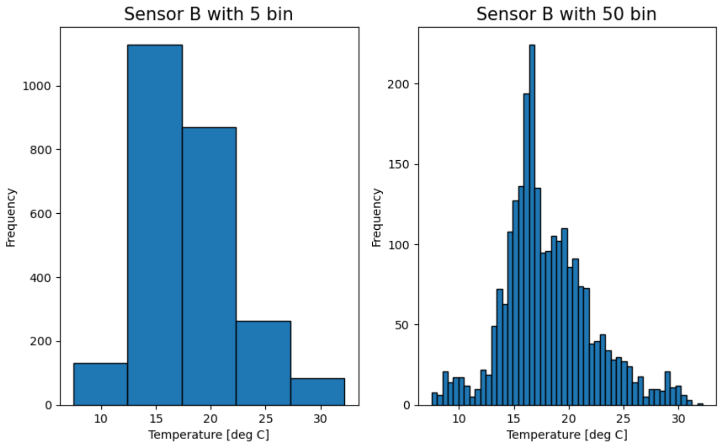

Figure 2: bin comparison between temperature variable in sensor B

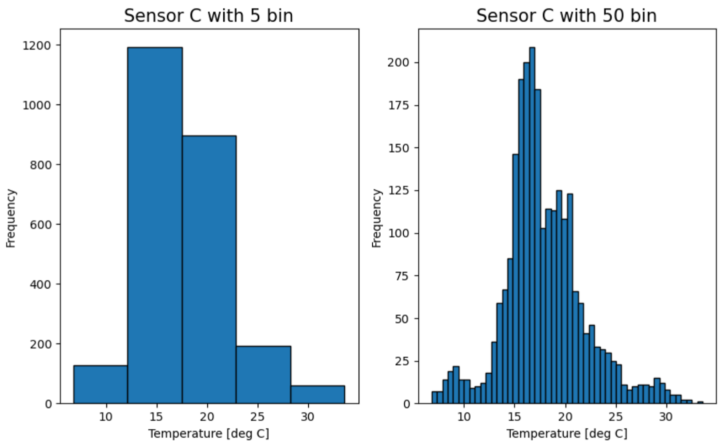

Figure 3: bin comparison between temperature variable in sensor C

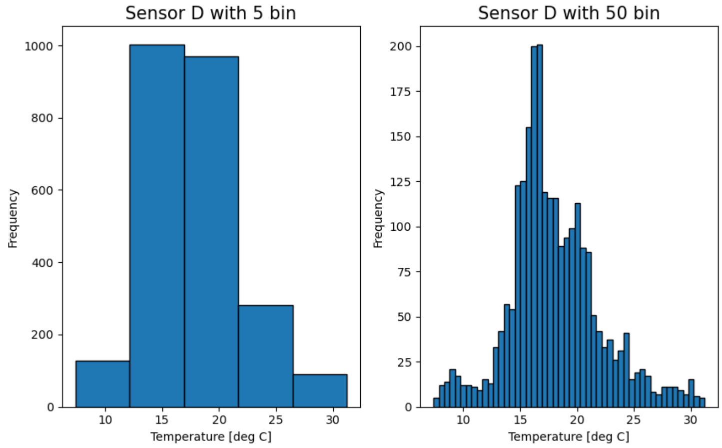

Figure 4: bin comparison between temperature variable in sensor D

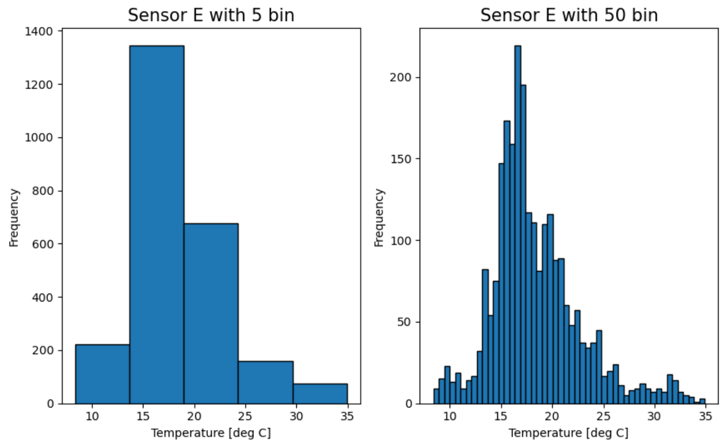

Figure 5: bin comparison between temperature variable in sensor E

3. *Create 1 plot where frequency poligons for the 5 sensors Temperature values overlap in different colors with a legend*

   Number of bin using in this frequency poligons is measured with Rice's Rule therefore the number of bin is 27.

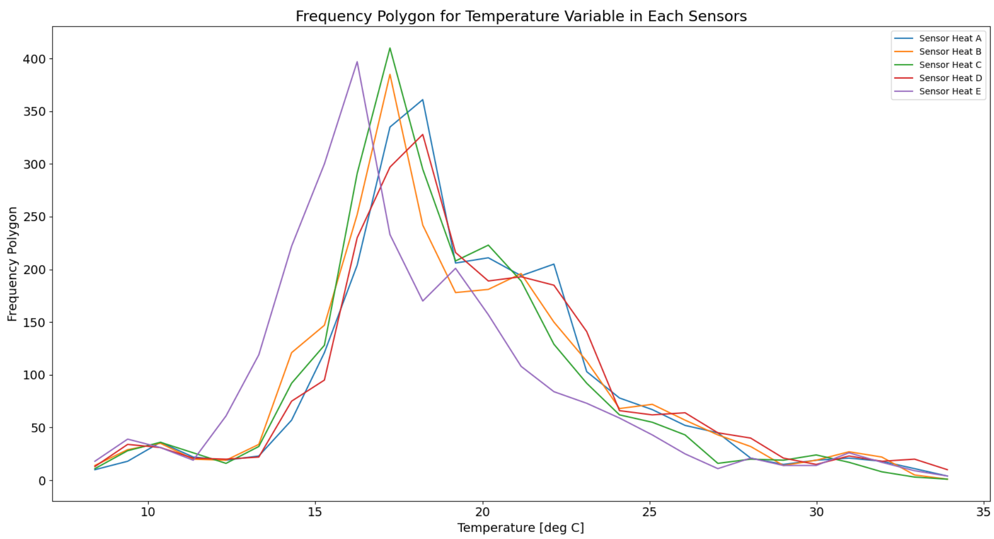

Figure 6: Frequency Polygons for The 5 Sensors Temperature Values Overlap in Different Colors

4. *Generate 3 plots that include the 5 sensors boxplot for: Wind Speed, Wind Direction and Temperature.*

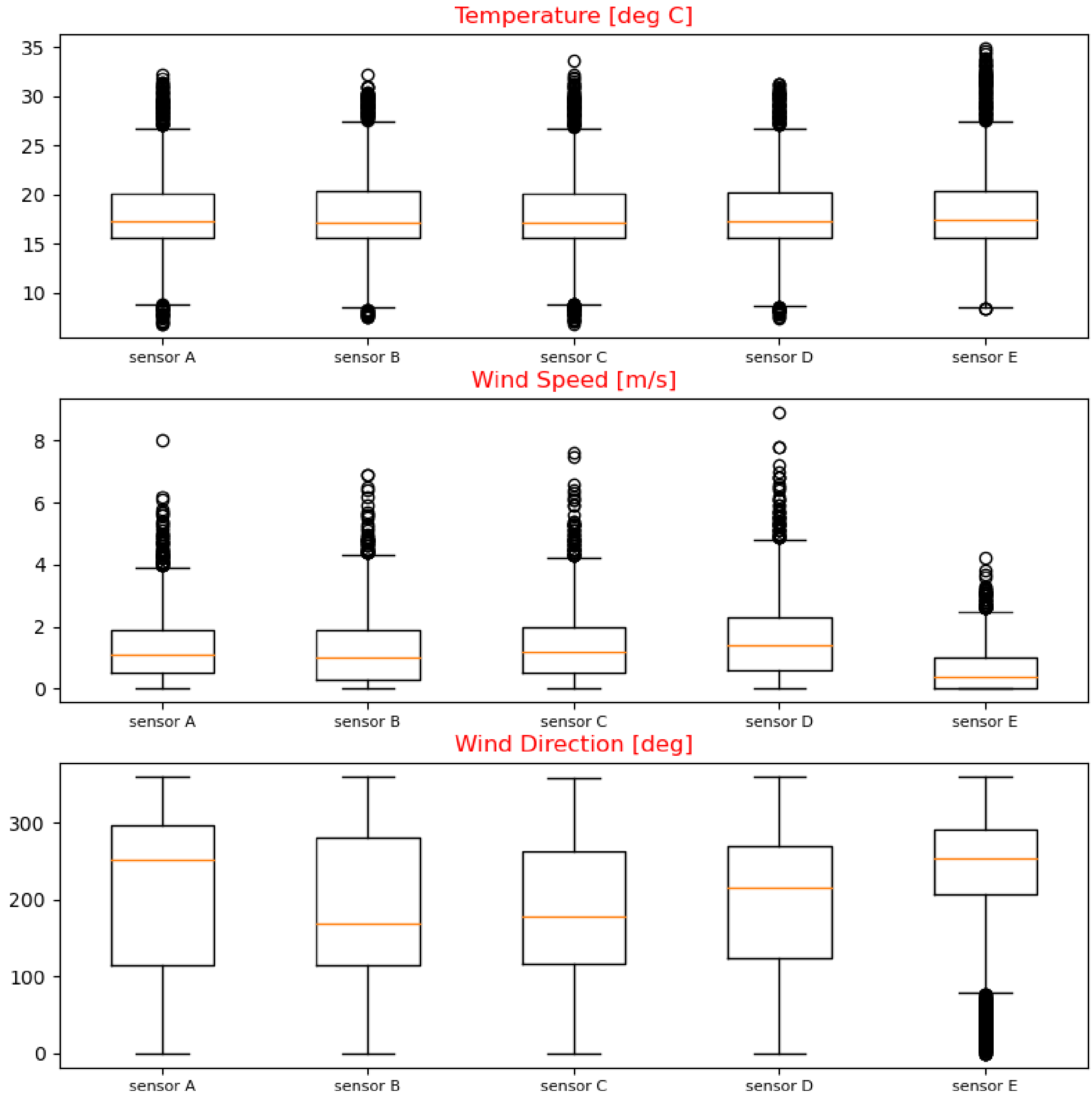

Figure 7: Boxplot Visualization for Temperature, Wind Speed and Wind Direction Variables for Sensor A, B, C, D and E

After Lesson 02.

1. *Plot PMF, PDF and CDF for the 5 sensors Temperature values in independent plots (or subplots). Describe the behaviour of the distributions, are they all similar? what about their tails?.*

   Figure 8, 9 and 10 are the PMF, PDF and CDF for the variable temperature. In these three distribution the pattern of the temperature variable is pretty similar, we can see this by looking at the bottom right of each figure where all distribution value from each sensor is overlap (example : on the bottom right of figure 8). But the data represent in PMF, PDF and CDF itself are different. In PMF distribution (figure 9), we can see the tails are more spread out compared to PDF distribution and there are more tails on the right side of the distribution than on the left side.

While in PDF distribution, the distribution is denser at the center and less dense at its tails. In CDF distribution (figure 10), there are slope and steep area. The steep area is starting around 15 deg C to 25 deg C, from this we can say that the temperature around 15 - 20 deg C has more frequency than others.

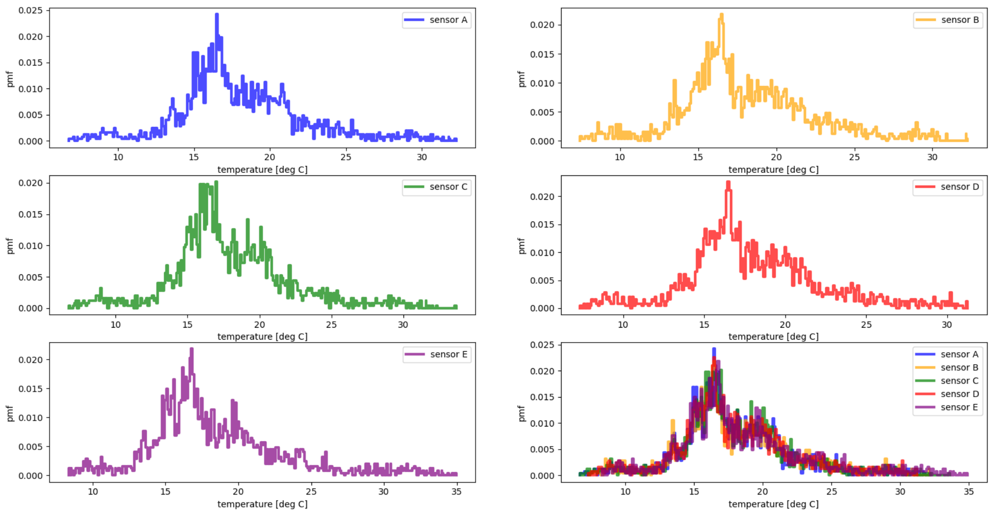

Figure 8: PMF Distribution for Temperature Variable in Sensor A, B, C, D and E

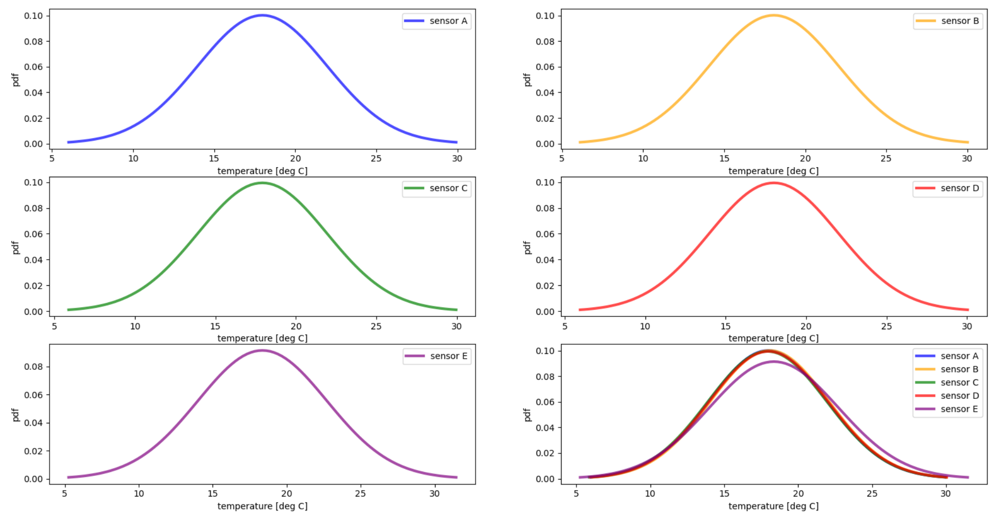

Figure 9: PDF Distribution for Temperature Variable in Sensor A, B, C, D and E

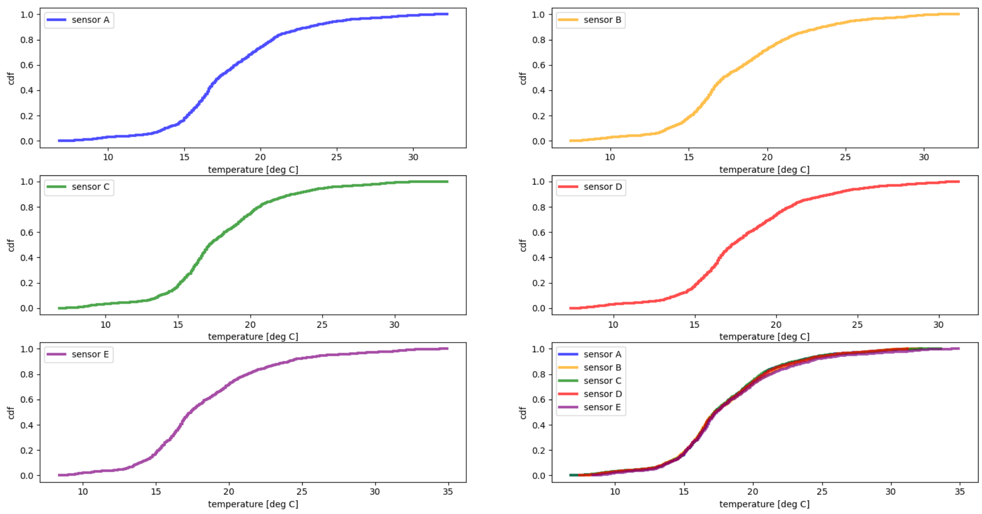

Figure 10: CDF Distribution for Temperature Variable in Sensor A, B, C, D and E

2. *For the Wind Speed values, plot the pdf and the kernel density estimation. Comment the differences.*

   PDF distribution and KDE distribution are shown in figure 11 and figure 12. The original distribution of wind speed is likely to be large positive skew, we can see it from the PDF and KDE distribution that zero value is close to the "almost peak point" of the distribution. The PDF Distribution is tend to be more dense at its center and less dense at its tails. While the KDE Distribution still computing the value at its tails. Furthermore, KDE using gaussian distribution to filter and smooth the data therefore in the center of the distribution is slightly different with PDF distribution. Hence estimating a density function with KDE is useful especially for interpolation and simulation.

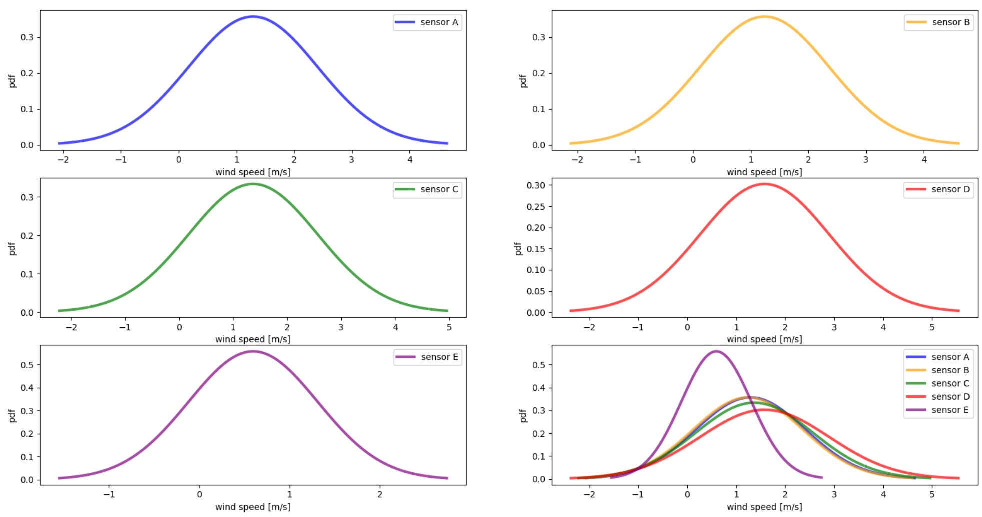

Figure 11: PDF Distribution for Temperature Variable in Sensor A, B, C, D and E

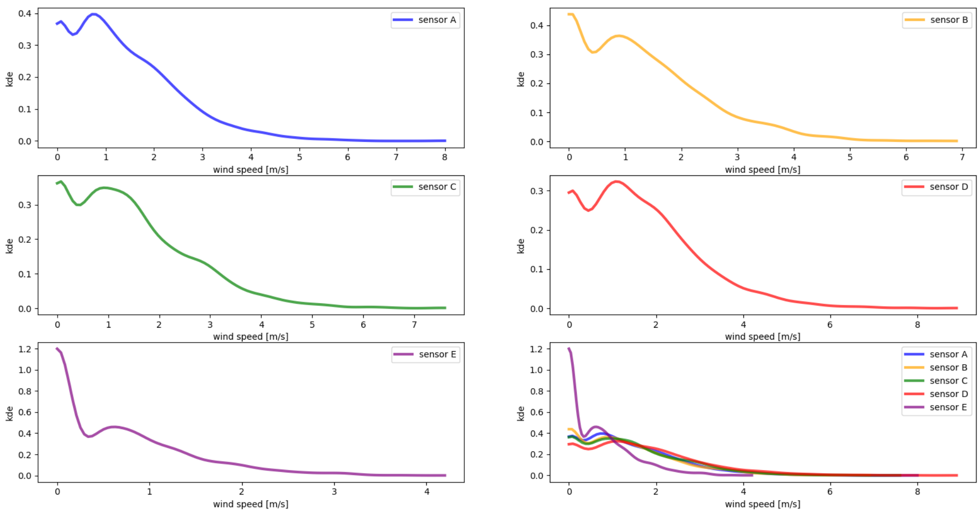

Figure 12: PDF Distribution for Temperature Variable in Sensor A, B, C, D and E

After Lesson 03.

1. *Compute the correlations between all the sensors for the variables: Temperature, Wet Bulb Globe Temperature (WBGT), Crosswind Speed. Perform correlation between sensors with the same variable, not between two different variables; for example, correlate Temperature time series between sensor A and B. Use Pearson's and Spearmann's rank coefficients. Make a scatter plot with both coefficients with the 3 variables.*

sensor	A	B	C	D	E
A	-	0.9880961160961108	0.9886087185252324	0.985613462024904	0.9692047916162703
B	0.9880961160961108	-	0.9844851698356614	0.9862654029844033	0.9713657061948098
C	0.9886087185252324	0.9844851698356614	-	0.988742872420724	0.9720972146615465
D	0.985613462024904	0.9862654029844033	0.988742872420724	-	0.9713657061948098
E	0.9692047916162703	0.9713657061948098	0.9720972146615465	0.9713657061948098	-

Table 3: Pearson Coefficient Correlation For Temperature Variable in Every Sensors from A to E

sensor	A	B	C	D	E
A	-	0.9873789546525072	0.9882920066209426	0.9846272388693882	0.9717698000821421
B	0.9713657061948098	-	0.9854401094930247	0.9860487230587479	0.9758482550943606
C	0.9882920066209426	9846272388693882	-	0.988742872420724	0.9720972146615465
D	9846272388693882	0.9860487230587479	0.988742872420724	-	0.9713657061948098
E	0.9717698000821421	0.9758482550943606	0.9720972146615465	0.9713657061948098	-

Table 4: Spearman Coefficient Correlation For Temperature Variable in Every Sensors from A to E

sensor	A	B	C	D	E
A	-	0.5503525849570334	0.5140508798931694	0.4898950130186933	0.46512468511971494
B	0.46519207768485005	-	0.5161024168073268	0.48802933817375804	0.46519207768485005
C	0.5140508798931694	0.5161024168073268	-	0.5628881993613143	0.4732332283201256
D	0.4898950130186933	0.48802933817375804	0.5628881993613143	-	0.46519207768485005
E	0.46512468511971494	0.46519207768485005	0.4732332283201256	0.46519207768485005	-

Table 5: Pearson Coefficient Correlation For Crosswind Speed Variable in Every Sensors from A to E

sensor	A	B	C	D	E
A	-	0.5969825624049757	0.5772288910798762	0.6018890586328168	0.5378446650454964
B	0.5273253265612854	-	0.5906839137964633	0.604818772469813	0.5273253265612854
C	0.5772288910798762	0.5906839137964633	-	0.6359061682587346	0.5322320929791761
D	0.6018890586328168	0.604818772469813	0.6359061682587346	-	0.5273253265612854
E	0.5378446650454964	0.5273253265612854	0.5322320929791761	0.5273253265612854	-

Table 6: Spearman Coefficient Correlation For Crosswind Speed Variable in Every Sensors from A to E.

sensor	A	B	C	D	E
A	-	0.9912595533881616	0.9918958502071861	0.9870139489166732	0.9498286924654158
B	0.9912595533881616	-	0.9897296935232769	0.9878642090483686	0.9480902122116057
C	0.9918958502071861	0.9897296935232769	-	0.9918205586342286	0.9492695317424185
D	0.9870139489166732	0.9878642090483686	0.9918205586342286	-	0.9480902122116057
E	0.9498286924654158	0.9480902122116057	0.9492695317424185	0.9480902122116057	-

Table 7: Pearson Coefficient Correlation For Wet Bulb Globe Temperature Variable in Every Sensors from A to E.

sensor	A	B	C	D	E
A	-	0.9921324359540058	0.9924720182971508	0.9882919234478525	0.9491275351688659
B	0.9487020195244296	-	0.9898635757569907	0.9873748114350143	0.9487020195244296
C	0.9924720182971508	0.9898635757569907	-	0.9914219338897717	0.9493455874960454
D	0.9882919234478525	0.9873748114350143	0.9914219338897717	-	0.9487020195244296
E	0.9491275351688659	0.9487020195244296	0.9493455874960454	0.9487020195244296	-

Table 8: Spearman Coefficient Correlation For Wet Bulb Globe Temperature Variable in Every Sensors from A to E.

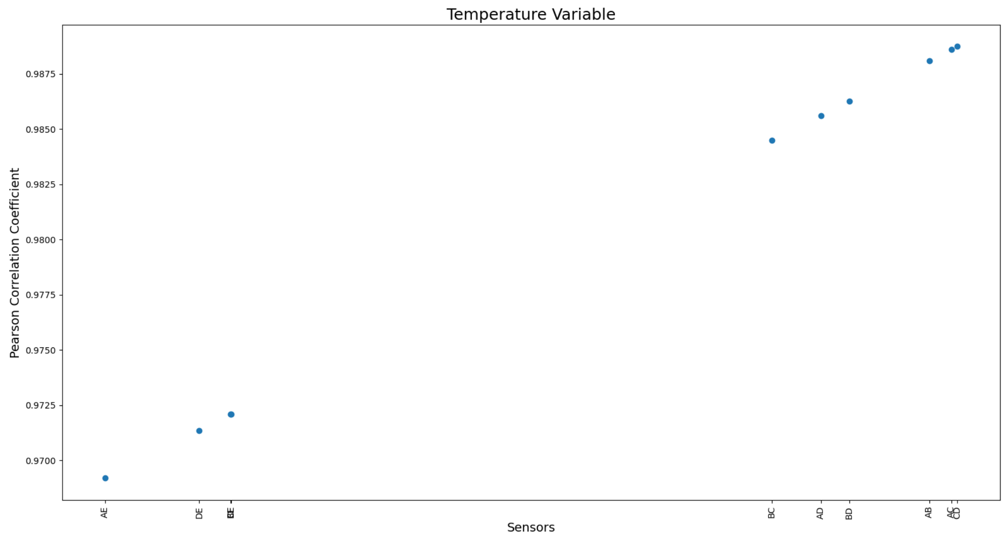

Figure 13: Scatter Plot of Pearson Correlation Coefficient in Temperature Variable for Every Correlation Between Sensors

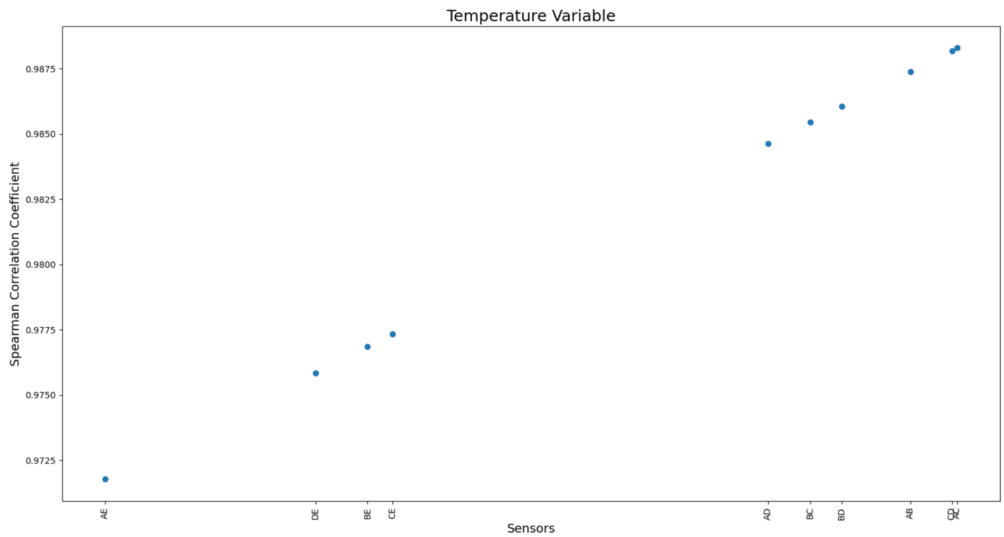

Figure 14: Scatter Plot of Spearman Correlation Coefficient in Temperature Variable for Every Correlation Between Sensors

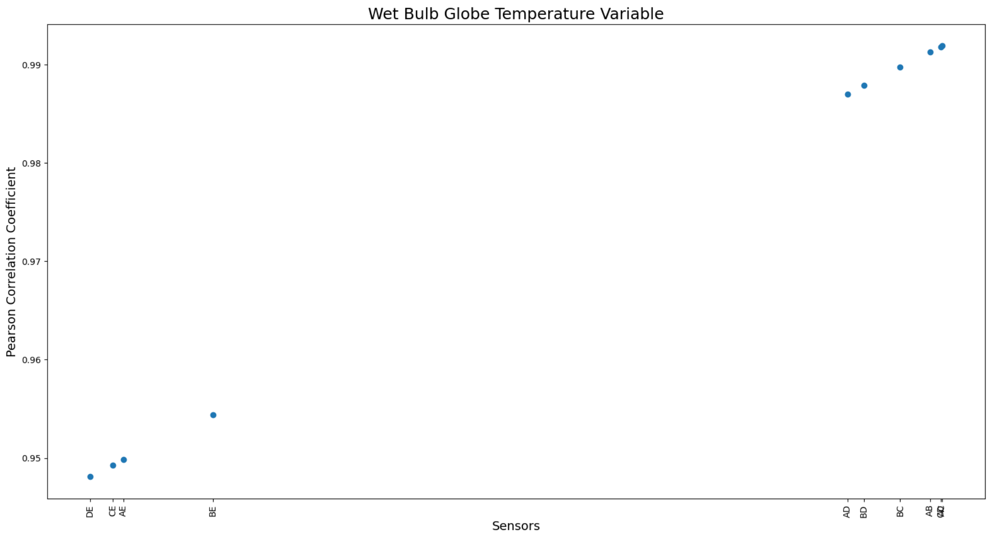

Figure 15: Scatter Plot of Pearson Correlation Coefficient in WBGT Variable for Every Correlation Between Sensors

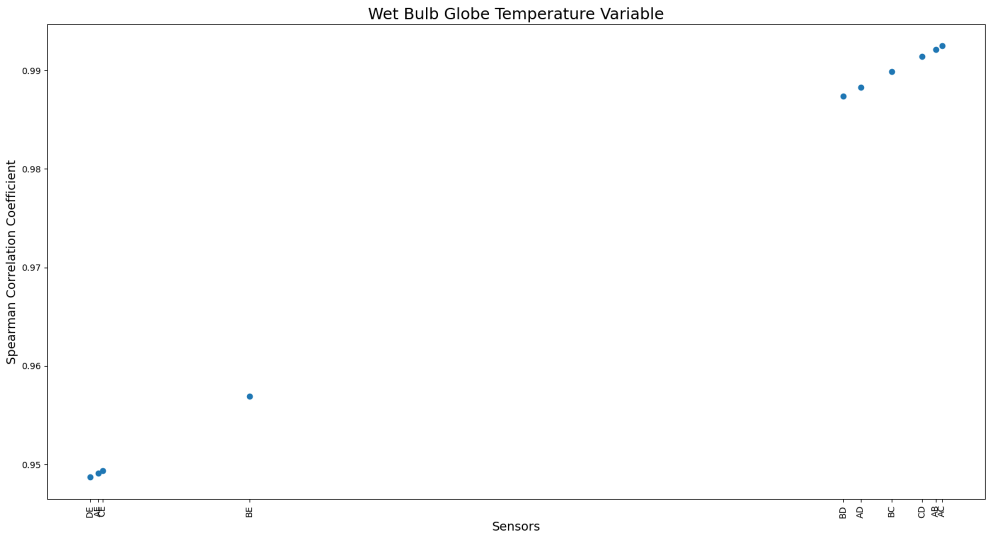

Figure 16: Scatter Plot of Spearman Correlation Coefficient in WBGT Variable for Every Correlation Between Sensors

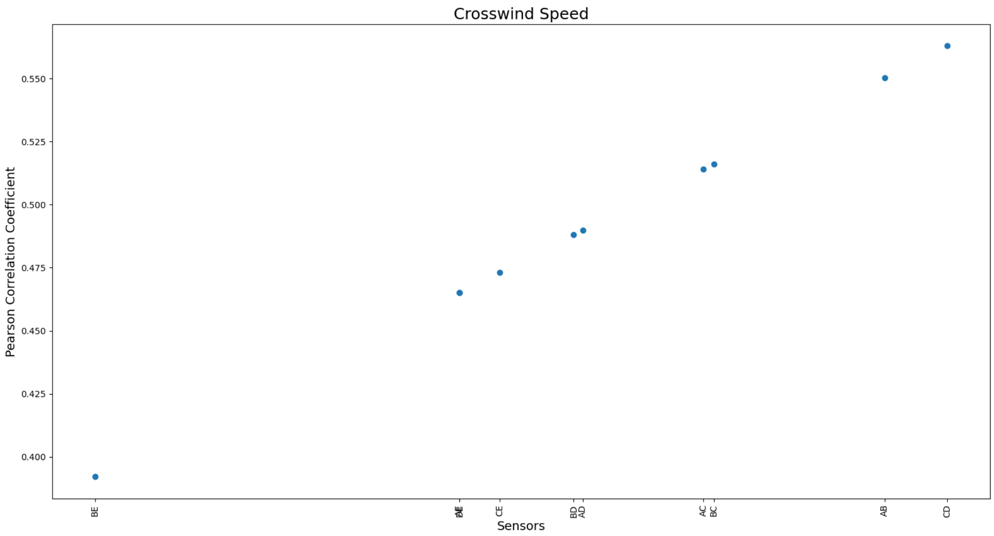

Figure 17: Scatter Plot of Pearson Correlation Coefficient in Crosswind Speed Variable for Every Correlation Between Sensors

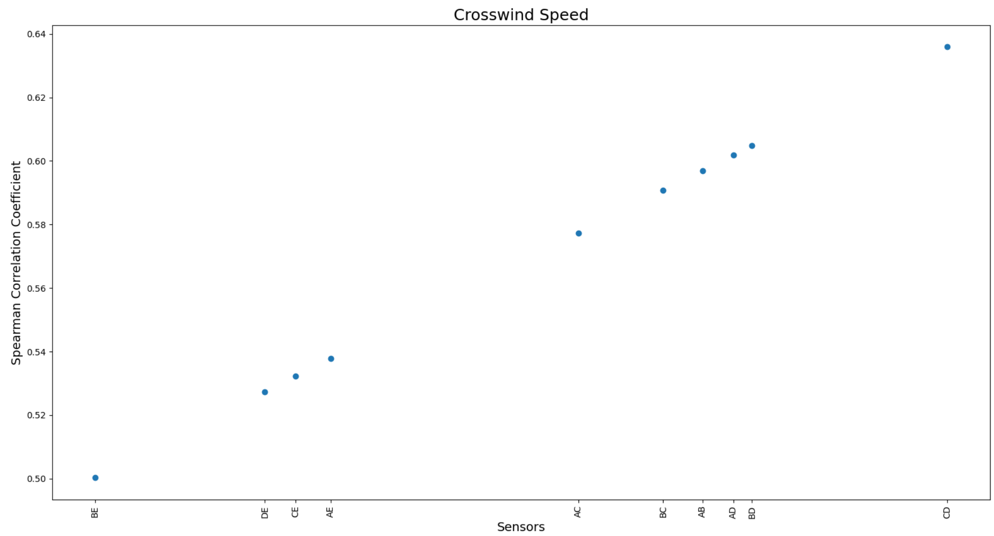

Figure 18: Scatter Plot of Spearman Correlation Coefficient in Crosswind Speed Variable for Every Correlation Between Sensors

2. *What can you say about the sensors' correlations?.*

   The Pearson and Spearman Correlation Coefficient is almost the same for correlations between all the sensors for the temperature, WBGT and crosswind speed as we can see from Table 3 to Table 8. The coefficient for Pearson and Spearman Correlation for temperature variable has a value almost 1 therefore the temperature variable has a very strong relationship in each sensor. For example, if the temperature in sensor A is increasing then temperature in sensor D is increase too. This also aplies to variable WBGT because the value of its coefficient is almost 1. But The Pearson and Spearman Correlation Coefficient for crosswind speed has value around 0.4 - 0.5, therefore this variable is not related to each other sensor. If the value of crosswind speed is increasing in sensor A, it is uncertain whether the value of crosswind speed is increasing too in another sensor.

3. *If we told you that that the sensors are located as follows, hypothesize which location would you assign to each sensor and reason your hypothesis using the correlations..*

   We have to look at the scatter plot from Figure 13 to Figure 18 (some correlation sensor in x axis are not clearly enough to see because of the very close value). if we see the scatter plot, we can see that sensor E has the lowest coefficient in every correlation with other sensor therefore the location of the sensor E must be different from the others. Then, if we check the coefficient at table 3-8, sensor C-D and sensor A-B is relatively related therefore they must be located on the same area.

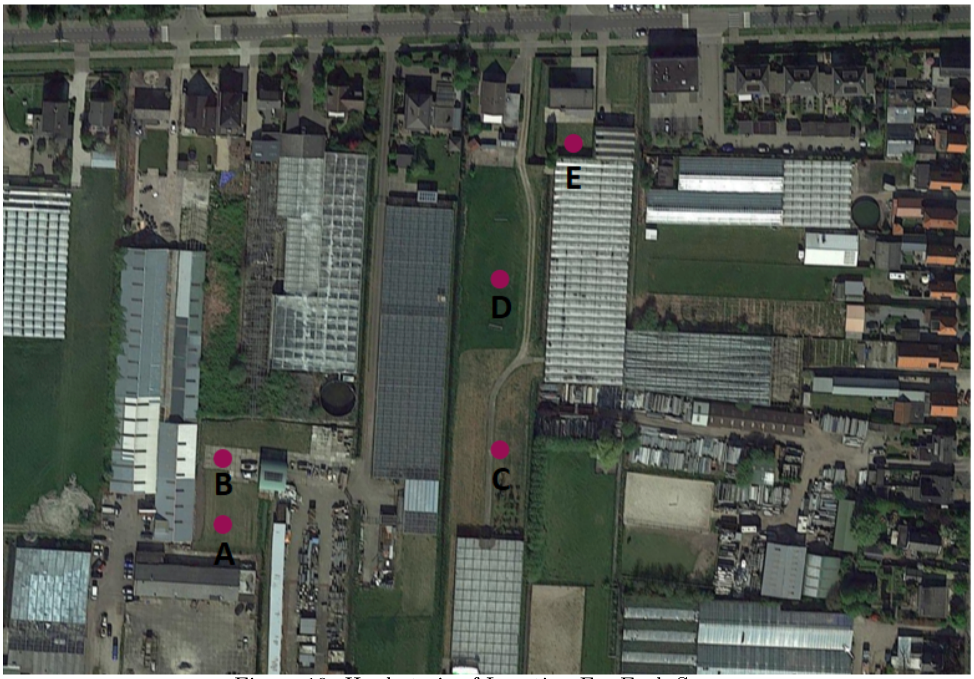

Figure 19: Hyphotesis of Location For Each Sensor

After Lesson 04.

1. *Plot the CDF for all the sensors and for variables Temperature and Wind Speed, then compute the 95 confidence intervals for variables Temperature and Wind Speed for all the sensors and save them in a table (txt or csv form).*

Sensor	Confidence Interval of 95% [deg C]
Heat A	(17.81214113267346, 18.126065652463858)
Heat B	(17.90472689963894, 18.226129320070267)
Heat C	(17.754926235060246, 18.071347006653575)
Heat D	(17.83814660824381, 18.15457772482005)
Heat E	(18.181933946027776, 18.525944841851015)

Table 9: Confidence Interval of 95% Value of Temperature Variable

Sensor	Confidence Interval of 95% [m/s]
Heat A	(1.246227038990971, 1.3343868543854427)
Heat B	(1.1971663346979249, 1.287082453670411)
Heat C	(1.3243037885948932, 1.418622646328308)
Heat D	(1.5296480419653757, 1.633650260379006)
Heat E	(0.5680599051948441, 0.6244249432900044)

Table 10: Confidence Interval of 95% Value of Wind Speed Variable

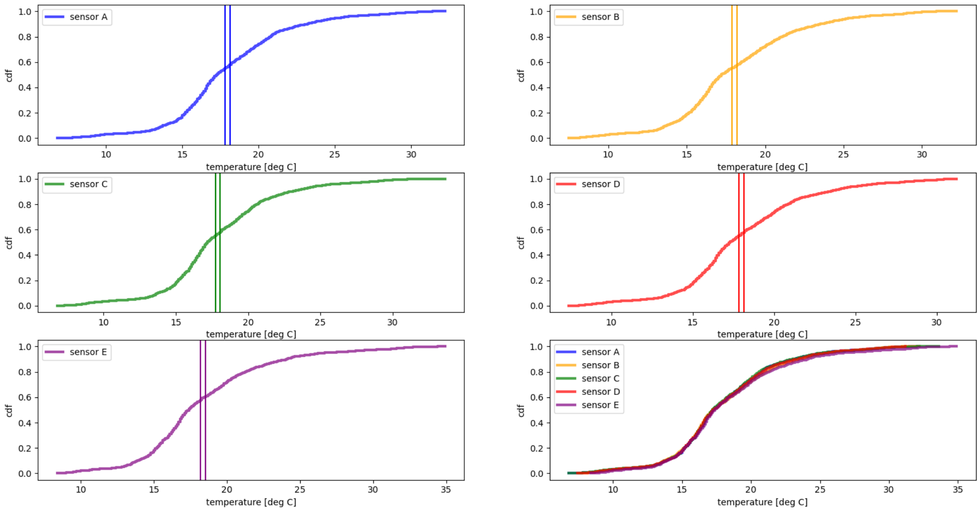

Figure 20: CDF of Temperature Variable for Each Sensor. The Vertical Line is The Value of Confidence Interval 95%

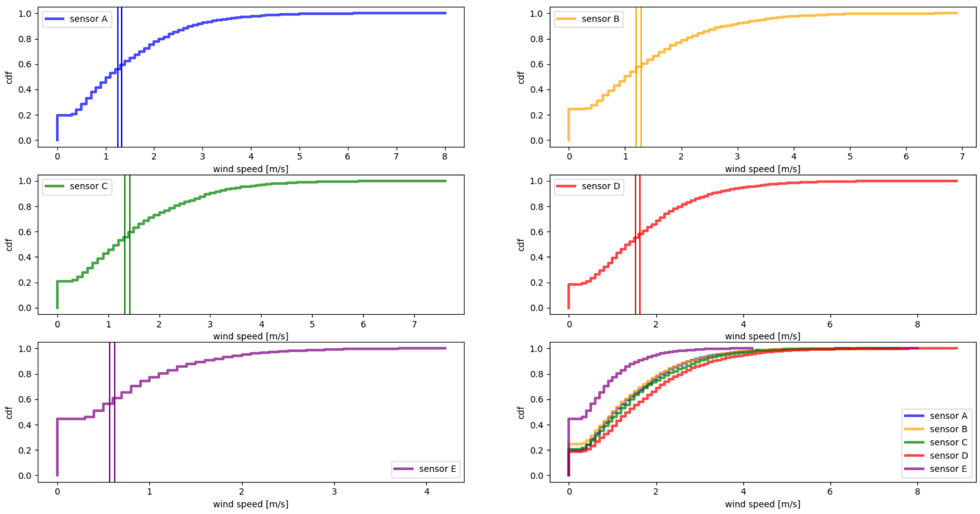

Figure 21: CDF of Wind Speed Variable for Each Sensor. The Vertical Line is The Value of Confidence Interval 95%

2. *Test the hypothesis: the time series for Temperature and Wind Speed are the same for sensors:*

   (a) E, D

   (b) D, C

   (c) C, B

   (d) B, A

   There are some steps to do hypothesis test. First, we have to do the test statistic. Second, define the null hypothesis. Third, compute p-value. Finally, the last step is to conclude whether it is significant or not.

   To check the test statistic, we can see from Table 11 which give information about the absolute difference between mean value from sensor E-D, D-C, C-B and B-A.

The highest different for temperature variable is between sensor E-D, meanwhile the lowest is between sensor D-C. Then, the highest different for wind speed variable is between sensor E-D and the lowest is between sensor B-A. Test statistic is only to quantify the size of the apparent effect. The bigger the differences, the farther the distance of central tendency. The next step is to define the null hypothesis, if we see the figure regarding the temperature or wind speed variable, above, we can see that each sensor has the same distribution of temperature and wind speed therefore there is no significant differences between each sensor.

After defining the null hypothesis, we can compute the p-value as shown in Table 12. From the Table 12, the smallest value is sensor E-D for temperature variable. If we convert this to percentage, the difference between sensor E-D in temperature variable is aroud 2% while the others have a bigger differences (sensor C-B with 18% and sensor D-C and B-A with more than 40%). By convention, 5% is the threshold of statistical significance therefore only sensor E-D is statistically significance for temperature variable and more likely to appear in the larger population.

For the wind speed variable, only sensor B-A that has different for more than 5%. Therefore another sensor beside sensor B-A are statistically significance for wind speed variable and more likely to appear in the larger population.

delta mean	ED	DC	CB	BA
delta mean wind speed [m/s]	0.985406727	0.210185934	0.129338823	0.048182553
delta mean for temperature [deg C]	0.357577227	0.083225546	0.152291489	0.096324717

Table 11: The Absolute Difference Between Mean Value in Its Sensor (To Compute This, Check Table 1)

sensor	p-value for Temperature	p-value for Wind Speed
E,D	0.002711172129731209	3.3729639501474365e-212
D,C	0.4657972008220813	4.610149126224334e-09
C,B	0.18548636717619374	0.00010045473692816457
B,A	0.4004754260262924	0.13351922750703515

Table 12: Comparison of P-Value in Some Sensors

3. *What could you conclude from the p-values?*

   The lower the p-value, the more statistic to be significant. The p-value compute the probability of apparent effect. From the hypothesis test above, we see that the null hypothesis for the combining sensor E-D, D-C, C-B and B-A has the same distribution but only sensor E-D has the number of p-value that less than 5%. Therefore only one combining sensor which is statistically significant

Bonus Question

Your "employer" wants to estimate the day of maximum and minimum potential energy consumption due to air conditioning usage. To hypothesize regarding those days, you are asked to identify the hottest and coolest day of the measurement time series provided. How would you do that? Reason and program the python routine that would allow you to identify those days.

First, we have to set temperature sensor that give measurement in time series. At least, there are two different sensor located in different places therefore we can the distribution value of both data. After having the temperature measurement we can do the statistic test by comparing both mean value. If both mean value are close to each other then the null hypothesis is both sensor has the same distribution. After that we can compute the p-value to confirm whether the null hypothesis is valid or not.

python code :
import math; import pandas as pd; import numpy as np; import thinkstats2;
import thinkplot; import matplotlib.pyplot as plt; from scipy import stats;
import scipy.stats as st; from scipy.stats import ttest ind
+++open data and set as array+++
df = pd.read [*path location*]
+++compute mean value and set null hyphothesis+++
tempA = temperatureA.mean(); tempB = temperatureB.mean()
dtemp = tempA-tempB
+++compute pvalue+++
ttest,pvaltemp = ttest ind(tempA,tempB)

References

[1] Daniela Maiullari and Clara Garcia Sanchez *Measured Climate Data in Rijsenhout* $https://data.4tu.nl/articles/dataset/Measured_{/}Climate_{D}ata_{i}n_{R}ijsenhout/12833918$