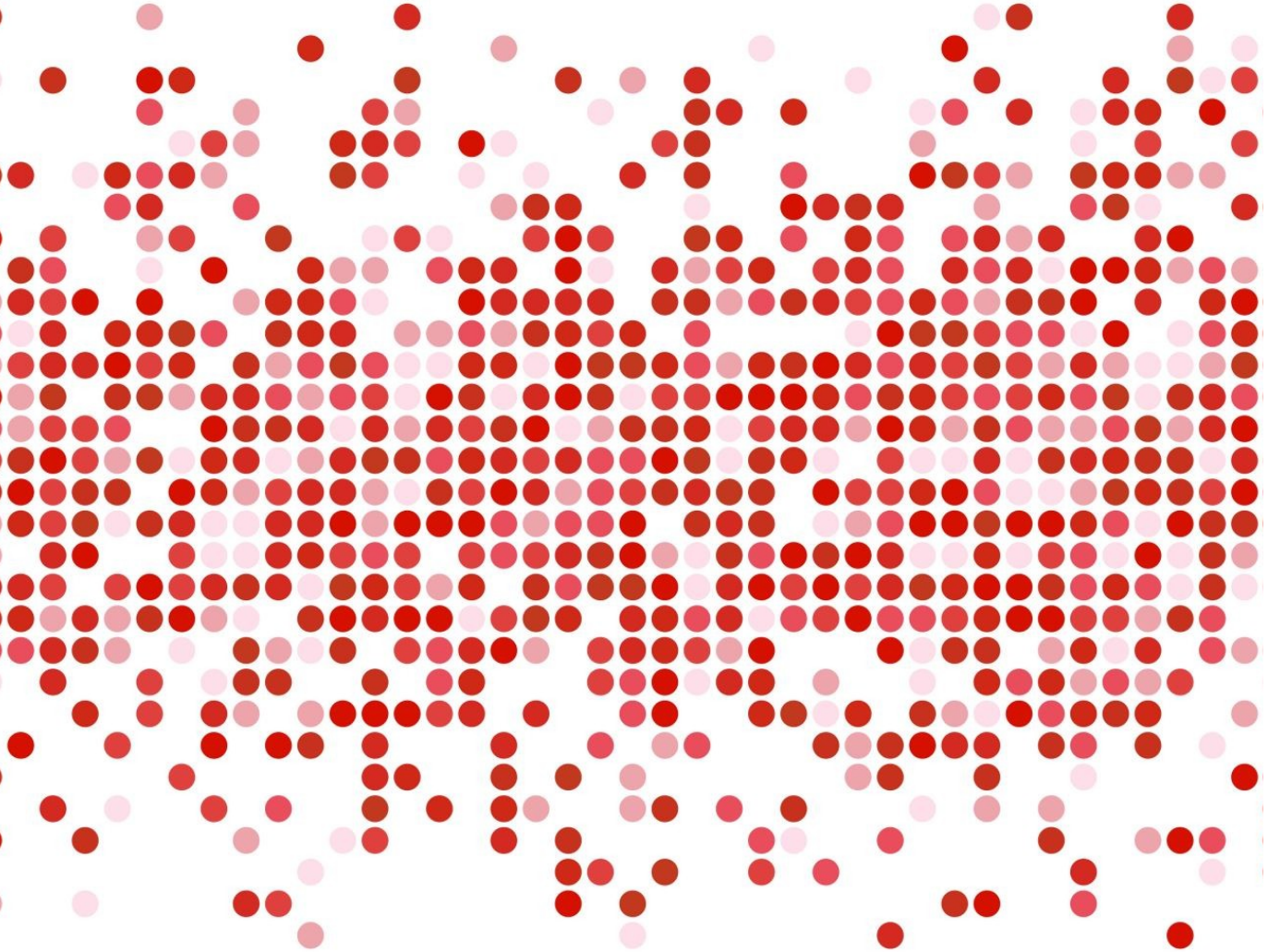


UNIVERSITY OF TRENTO
NEXT GENERATION NETWORKS

IMPORT AND ANALYZE ONLINE NETWORKING DATASETS

ETTORE SAGGIORATO

STIVEN SHARRA

PROF. FABRIZIO GRANELLI

REPOSITORY

GOAL

- Build a software for automated processing and visualization of extracted information from online datasets

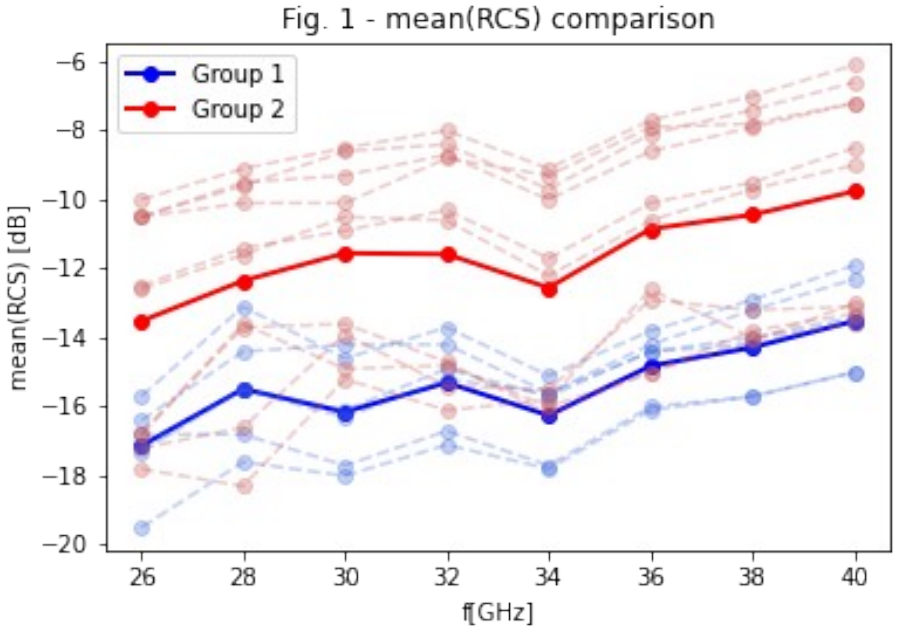
- Build a Software for distinction of drones according to RCS measurments

TABLE 2

Mean, standard deviation and maximal value of the RCS of each drone over the frequency range

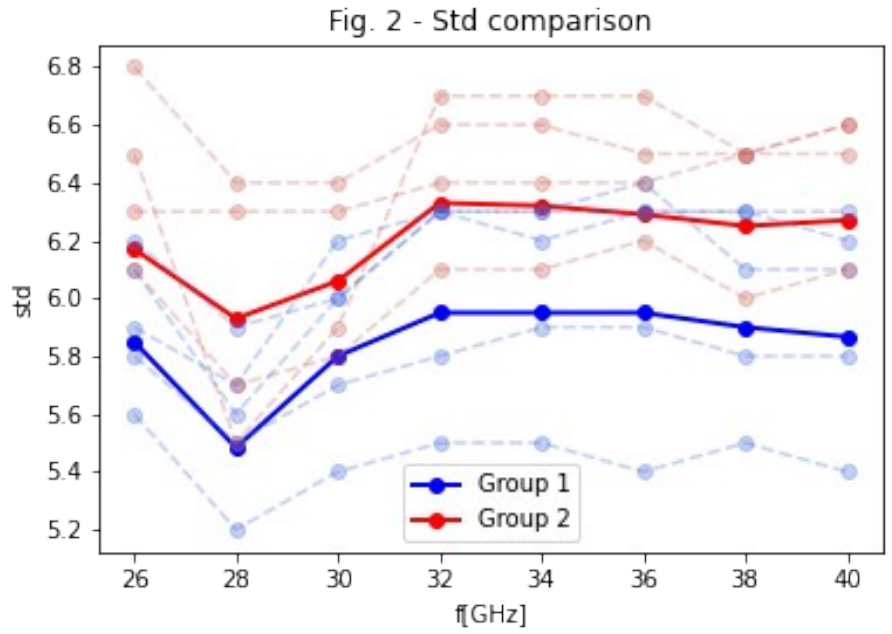
Model	26GHz			28GHz			30GHz			32GHz			34GHz			36GHz			38GHz			40GHz		
	μ	std	max	μ	std	max	μ	std	max	μ	std	max	μ	std	max	μ	std	max	μ	std	max	μ	std	max
Group I																								
F450 (HH)	-17.1	5.9	3.3	-15.5	5.7	6.3	-16.1	6.2	7.6	-14.9	6.3	7.0	-15.7	6.3	8.0	-14.4	6.4	8.1	-14.2	6.1	8.3	-13.5	6.1	9.3
Helicopter (HH)	-17.3	5.8	6.3	-15.5	5.5	2.3	-16.3	5.7	8.6	-15.2	5.8	6.9	-15.6	5.9	5.4	-14.4	5.9	12.4	-14.0	5.8	8.8	-13.4	5.8	8.4
Mavic (HH)	-16.8	6.1	2.3	-16.8	5.6	2.4	-17.7	6.0	4.3	-16.7	6.3	6.5	-17.7	6.2	1.7	-16.0	6.3	7.1	-15.7	6.3	6.5	-15.0	6.2	7.5
Parrot (HH)	-19.5	6.2	4.6	-17.6	5.9	3.1	-18.0	6.0	5.7	-17.1	6.3	6.5	-17.8	6.3	8.2	-16.1	6.3	7.7	-15.7	6.3	9.5	-15.0	6.3	11.7
P4P (HH)	-16.4	5.6	2.6	-14.4	5.2	1.1	-14.2	5.4	3.0	-14.2	5.5	1.8	-15.6	5.5	2.5	-14.2	5.4	3.11	-13.2	5.5	2.5	-12.3	5.4	5.7
P4P (VV)	-15.7	5.5	0.1	-13.1	5.0	5.4	-14.6	5.5	3.8	-13.7	5.5	4.1	-15.1	5.5	2.6	-13.8	5.4	2.8	-12.9	5.4	4.6	-11.9	5.4	5.1
Group II																								
Hexa (HH)	-10.5	6.3	10.9	-10.1	6.3	14.0	-10.1	6.3	11.5	-8.8	6.4	12.6	-9.3	6.4	20.0	-7.9	6.4	14.0	-7.8	6.5	15.0	-7.2	6.5	16.6
Hexa (VV)	-10.5	6.2	11.4	-9.5	5.8	11.9	-9.3	6.2	12.2	-8.7	6.4	14.0	-10.0	6.4	12.8	-8.6	6.4	14.9	-7.9	6.4	15.8	-7.2	6.4	18.3
M100 (HH)	-10.5	6.8	15.8	-9.6	6.4	19.6	-8.6	6.4	16.0	-8.4	6.6	20.0	-9.7	6.6	20.5	-8.1	6.5	20.3	-7.4	6.5	19.7	-6.6	6.6	22.5
M100 (VV)	-10.0	6.5	14.8	-9.1	6.3	23.0	-8.5	6.4	17.8	-8.0	6.6	20.9	-9.1	6.5	18.3	-7.7	6.6	19.4	-7.0	6.5	20.0	-6.1	6.5	25.0
M100 (VH)	-17.2	5.4	0.1	-16.6	5.3	5.5	-13.9	5.5	5.0	-15.4	5.7	3.3	-15.5	5.9	4.0	-12.9	5.7	5.5	-13.2	5.6	5.8	-13.1	5.8	7.0
M100 (HV)	-17.8	5.5	-1.3	-18.3	5.8	1.2	-15.2	5.8	3.8	-16.1	5.9	3.5	-15.8	5.9	4.5	-12.6	5.6	6.1	-14.0	5.7	5.0	-13.6	5.7	7.2
Walkera (HH)	-12.6	6.1	8.1	-11.6	5.7	9.2	-10.5	5.8	9.4	-10.6	6.1	10.0	-12.2	6.1	8.4	-10.6	6.2	12.3	-9.7	6.0	11.0	-9.0	6.1	11.7
Walkera (VV)	-12.5	5.8	7.4	-11.4	6.7	9.9	-10.9	6.0	9.3	-10.3	6.1	11.5	-11.7	6.0	8.7	-10.1	6.0	12.6	-9.5	6.0	11.4	-8.5	5.9	13.2
Y600 (HH)	-16.8	6.5	6.3	-13.7	5.5	8.0	-13.6	5.9	8.1	-14.7	6.7	9.3	-16.2	6.7	9.7	-15.0	6.7	10.0	-13.8	6.5	13.5	-13.3	6.6	12.3
Y600 (VV)	-16.8	6.6	6.7	-13.6	5.5	8.8	-14.9	6.3	7.8	-14.8	6.8	11.8	-16.0	6.7	9.1	-15.0	6.8	11.8	-14.1	6.8	11.8	-13.0	6.6	12.3

mean(RCS) comparison



- mean(RCS) of group I and II are significantly different
- mean(RCS) it grows increasing frequency, but it does not depend on the group or single drone
- Therefore, it is not necessary to use ALL the frequencies in the statistical model, and we can limit ourselves to a few (see table 2 of the paper)

Std comparison



- The Std does not depend on the drone or on the frequency
- difference of an order of magnitude
- we don't use it in the statistical model

HH – VV comparison

Fig. 3.0 - Std comparison - P4P

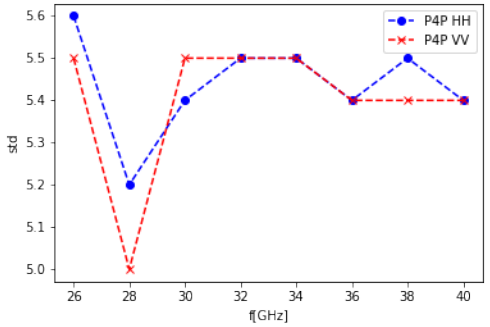


Fig. 3.2 - Std comparison - HEXA

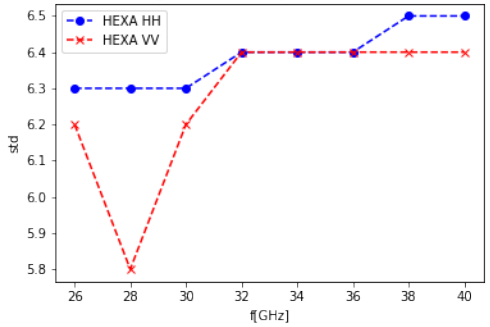


Fig. 3.4 - Std comparison - M100

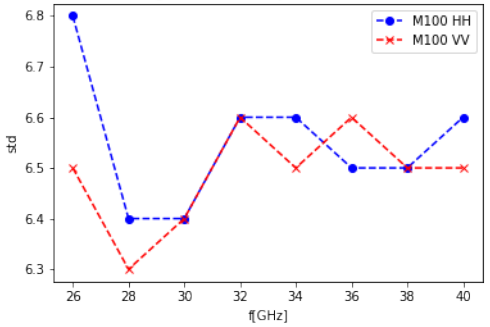


Fig. 3.6 - Std comparison - WALKERA

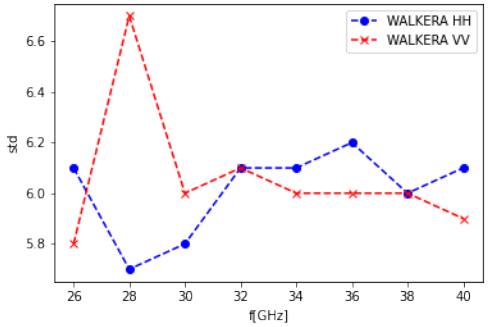


Fig. 3.8 - Std comparison - Y600

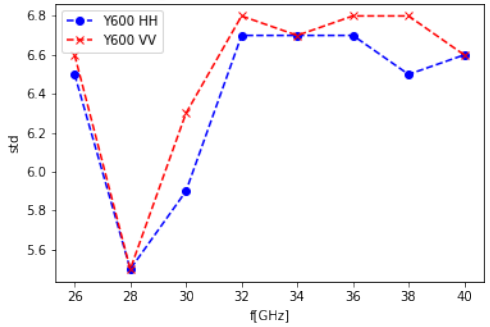


Fig. 3.1 - Mean comparison - P4P

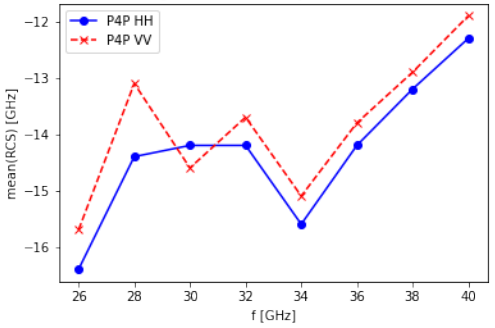


Fig. 3.3 - Mean comparison - HEXA

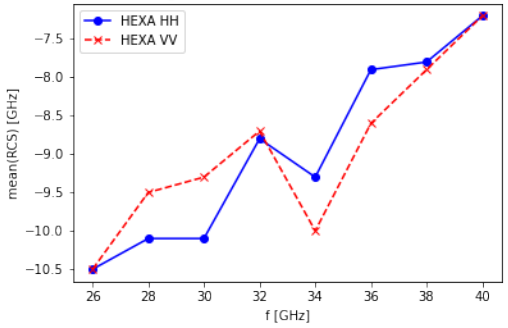


Fig. 3.5 - Mean comparison - M100

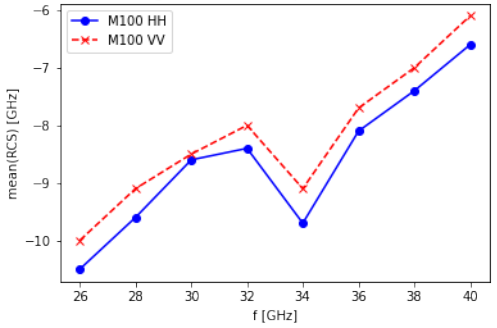


Fig. 3.7 - Mean comparison - WALKERA

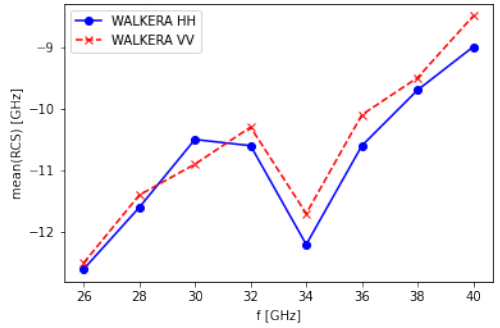
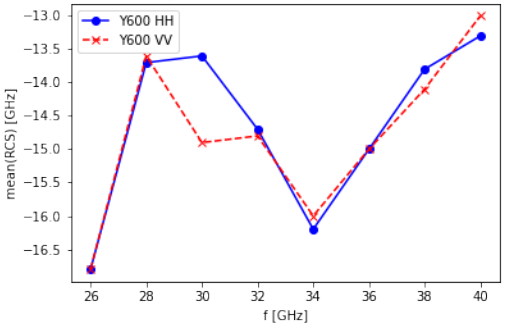


Fig. 3.9 - Mean comparison - Y600



Cross - polarization

Fig. 4.0 - Mean comparison - M100

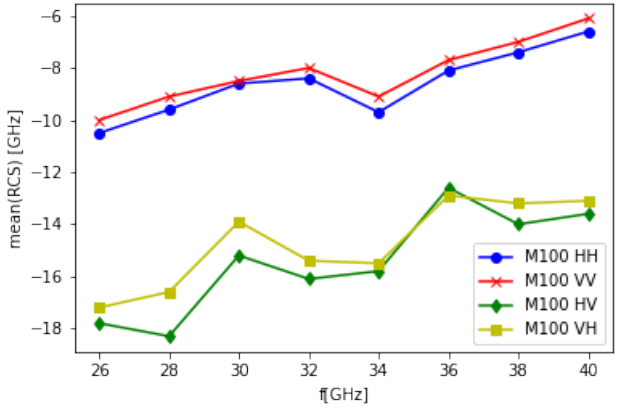
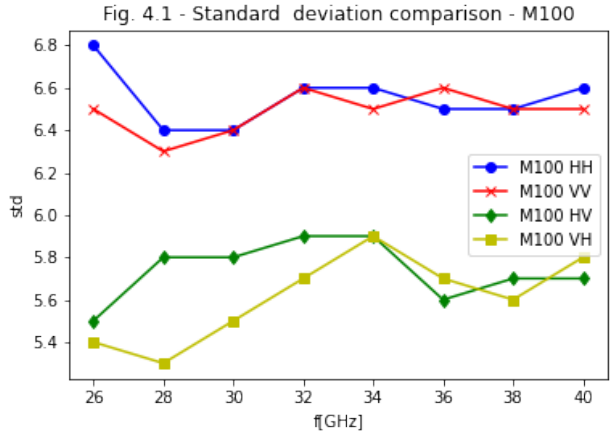
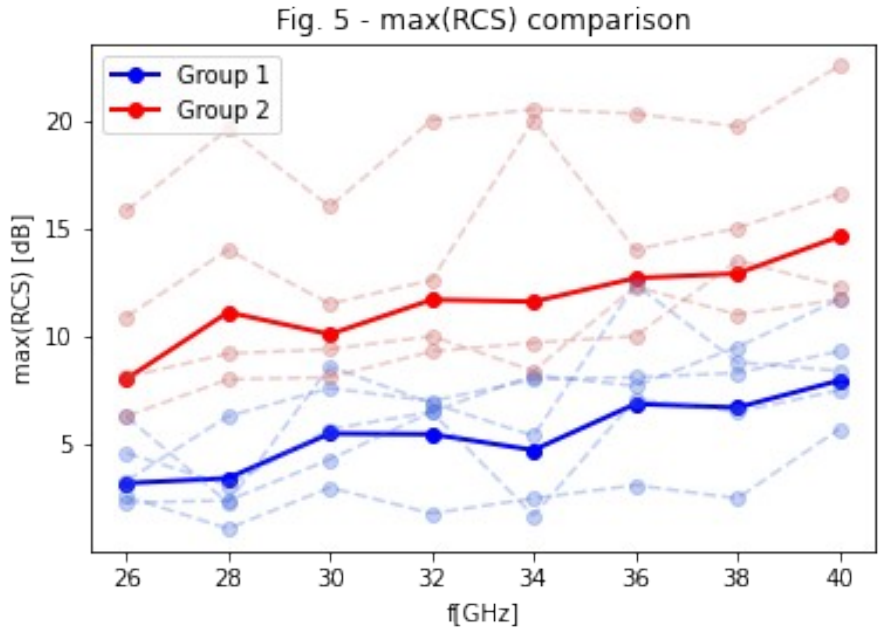


Fig. 4.1 - Standard deviation comparison - M100



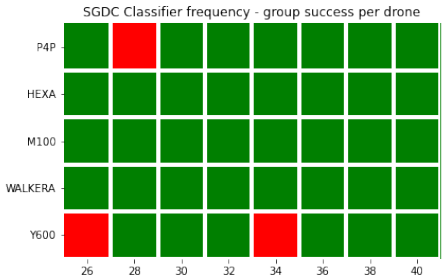
- HV cross-polarizations give small RCS compared to HH and VV, mean and std are smaller.
- HV’s std is offset from that of HH, we don't use HV.

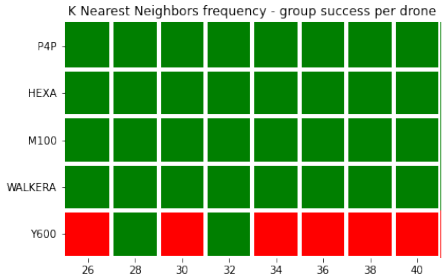
max(RCS) comparison

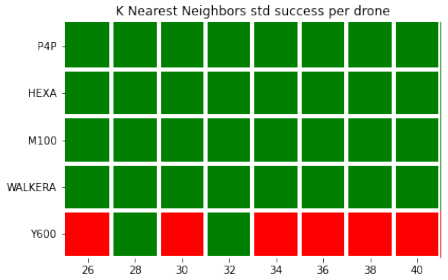


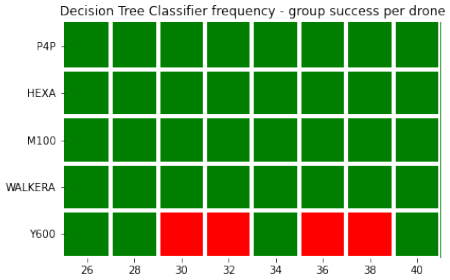
- max(RCS) is used to distinguish groups and/or single drones

Classifiers - Groups





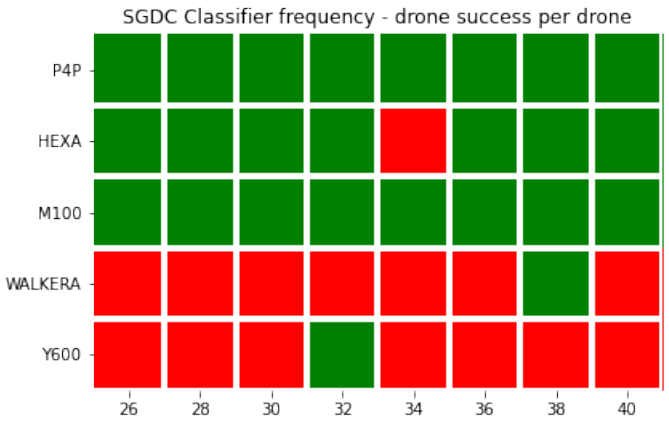




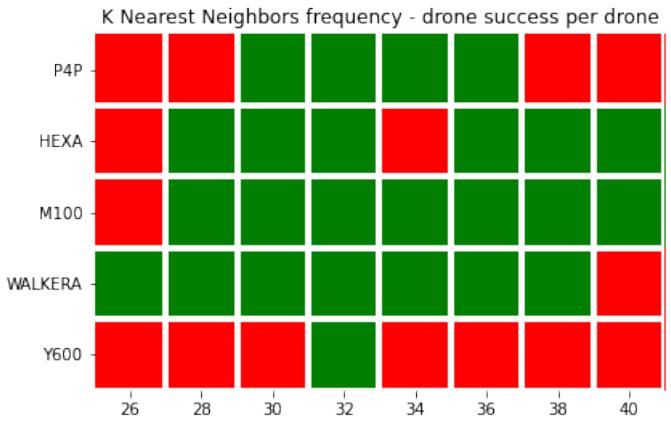
- The std has very little influence on the results, so it can be excluded

	NO Std		Std	
	HH	VV	HH	VV
SGDC	0,94	0,925	1,0	1,0
KNN	0,9	0,85	0,9	0,85
DTC	1,0	0,925	1,0	0,975

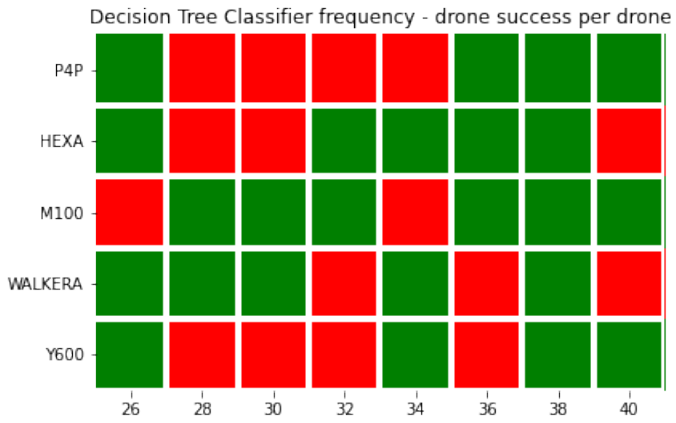
Classifiers - Drones



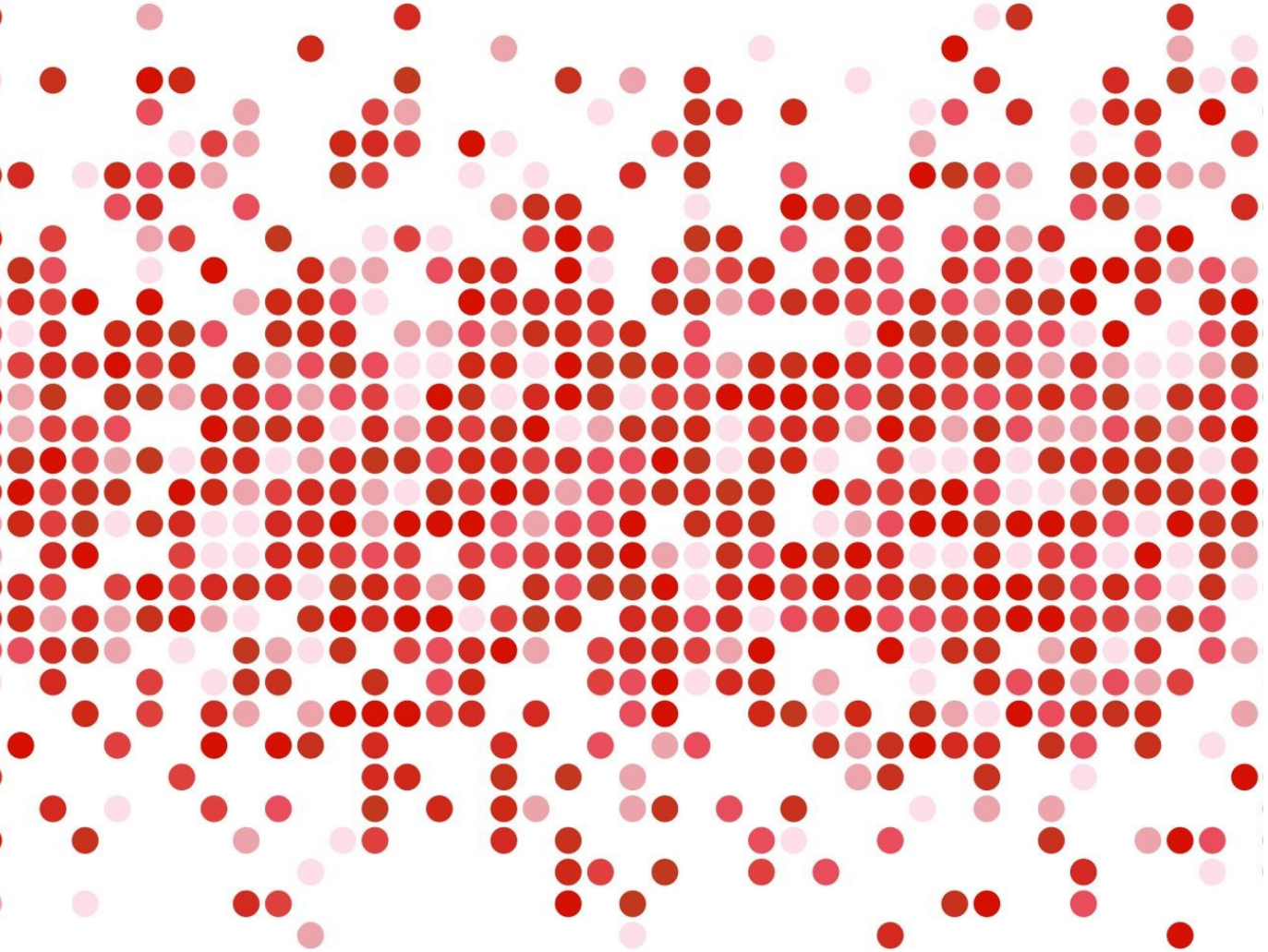
Score(HH): 0.61
Score(VV): 0.625



Score(HH): 0.49
Score(VV): 0.625



Score(HH): 1.0
Score(VV): 0.6



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