CSE523

Machine learning

Fuzzy Logic for Vehicle Motion Direction Detection

Group: The learner's squad

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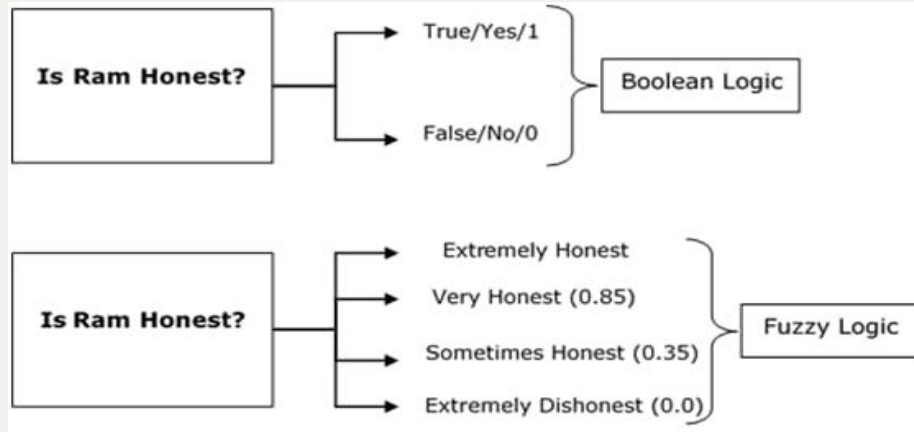
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What is fuzzy logic?

- Approximate

- Fuzzy sets

- Membership function

Fuzzy Logic - Quick Guide. (n.d.). Retrieved from
https://www.tutorialspoint.com/fuzzy_logic/fuzzy_logic_quick_guide.htm

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Data Set Explanation

There are seven entities:

1. Frm
2. Track
3. Xc
4. Yc
5. W
6. H
7. Velocity

Frm	Track	xc	yc	w	h	Velocity(kmph)
1	1	2373	1324	95	128	0
2	1	2376	1331	94	128	22.12735165
3	1	2378	1338	96	127	21.32106834
4	1	2381	1347	96	129	26.45146189
5	1	2384	1356	97	129	28.12338374
6	1	2387	1363	96	128	25.49540046
7	1	2390	1371	95	130	25.49809004
8	1	2393	1379	94	130	25.47731044
9	1	2395	1387	94	128	25.08667118
10	1	2398	1395	94	128	25.14730526
11	1	2402	1403	94	130	25.58595195
12	1	2405	1412	96	130	26.39773612
13	1	2408	1420	97	130	26.16989314
14	1	2411	1428	94	130	25.98810281
15	1	2413	1437	94	130	26.35463835
16	1	2416	1445	94	130	26.15008535
17	1	2419	1453	94	130	25.97926713
18	1	2422	1462	95	129	26.44989327
19	1	2425	1469	95	130	25.66228096
20	1	2427	1477	95	130	25.37886817

Table 1: Given dataset

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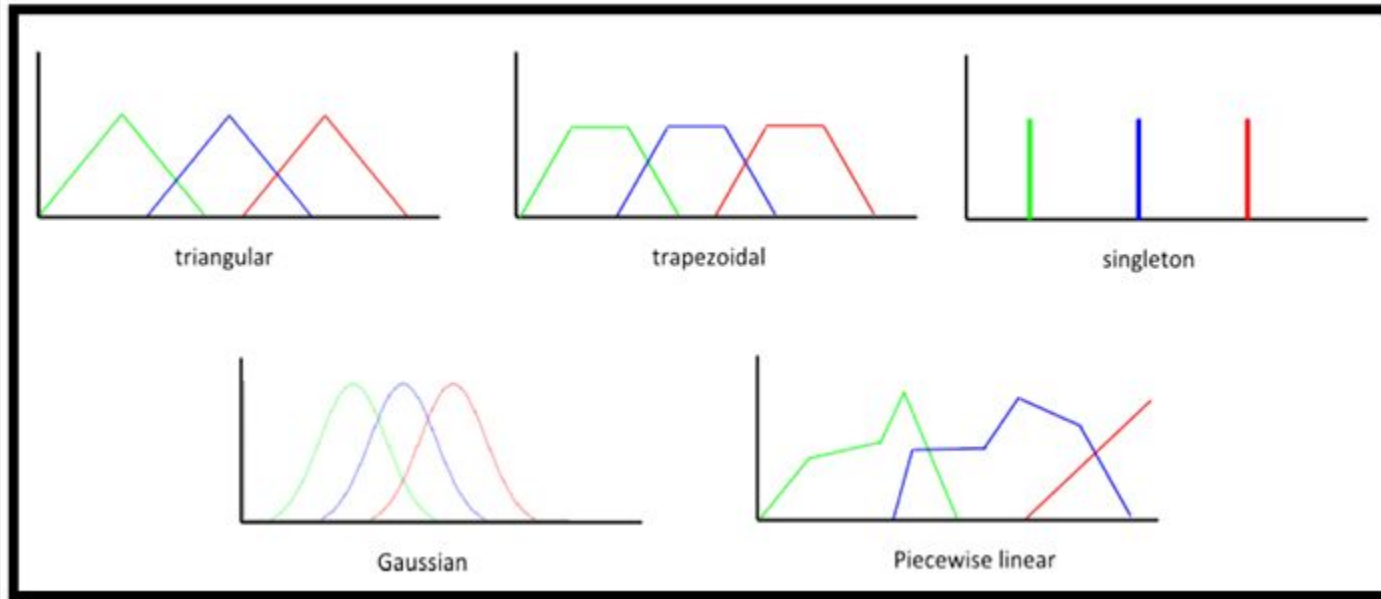University

METHODOLOGY

1. Data Analysis and Loading

2. Calculate Motion Vectors (Centroid Difference)

3. Angle Calculation

4. Applying Fuzzy Logic

5. Direction Categorization

6. Visualization
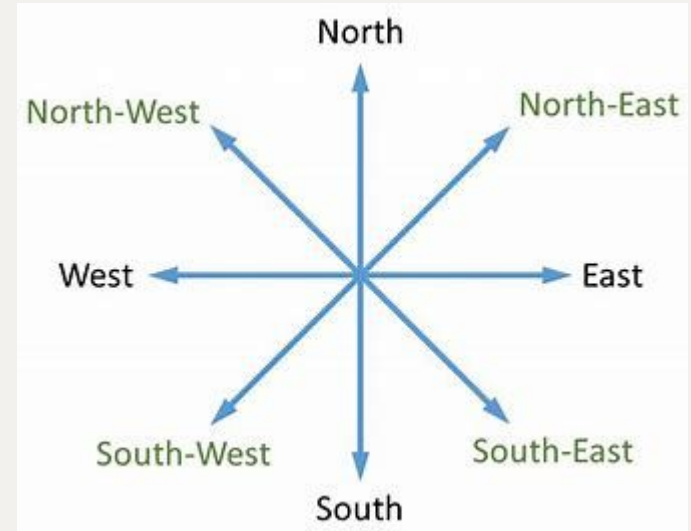
India, B. E. (2024). Cheatsheet: Directions: IBPS PO prelims and Mains - documents, videos and tests - bank exams PDF Download. Retrieved from https://edurev.in/t/255895/Cheatsheet-Directions

Different Methods:

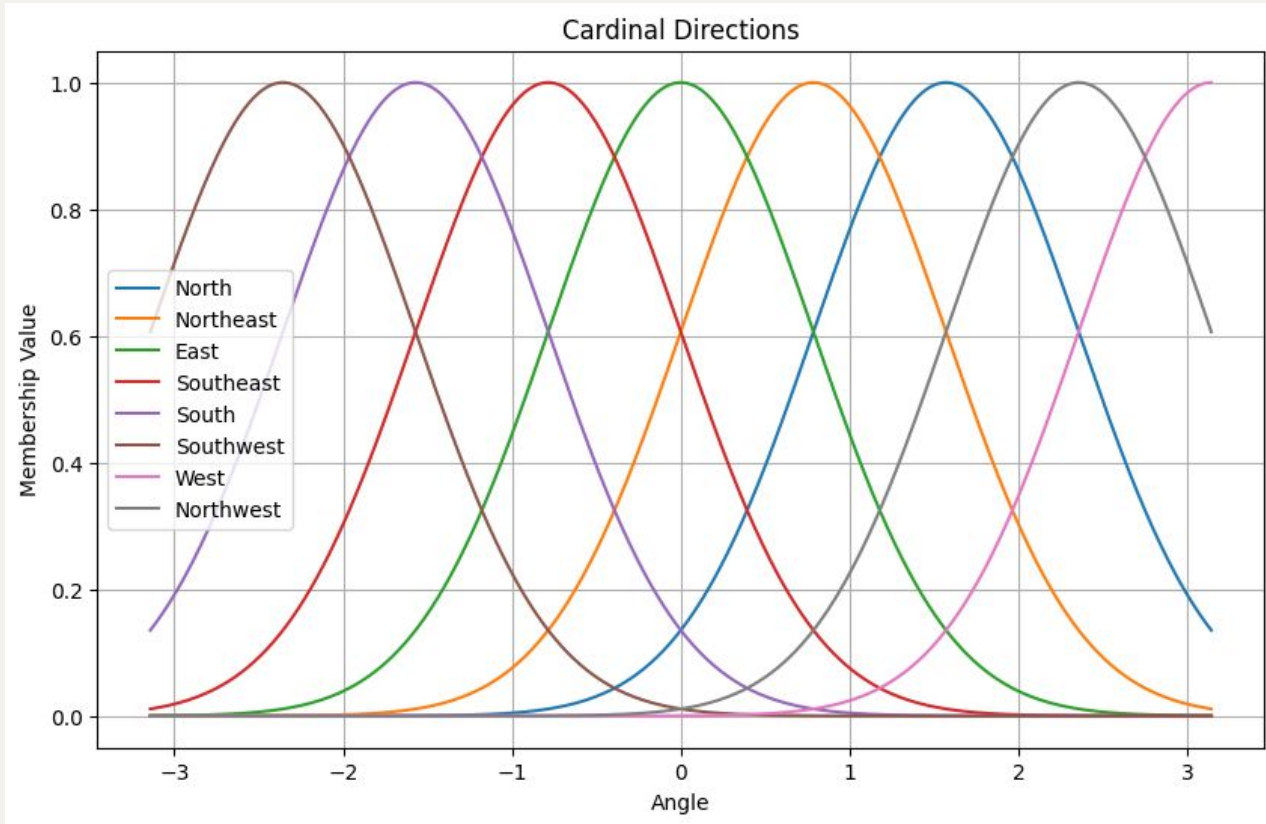triangular

trapezoidal

singleton

Gaussian

Piecewise linear

Lecture 18 - different types of membership functions 1. (n.d.). Retrieved from
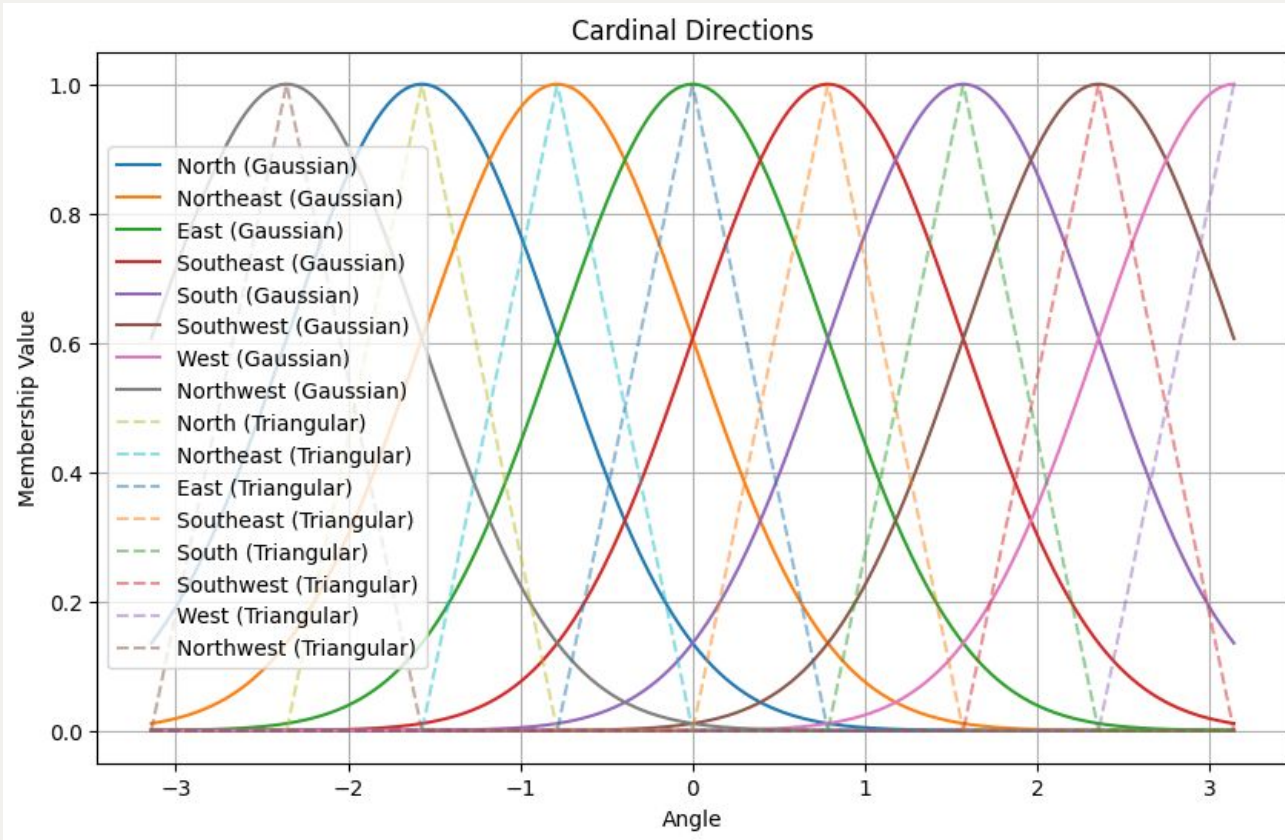https://www.scribd.com/document/493637688/Lecture-18-Different-Types-of-Membership-Functions-1
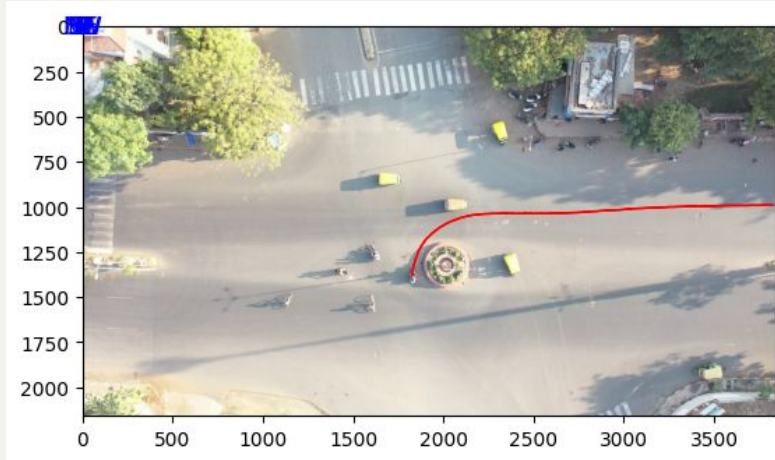
Triangular Approach:

Cardinal Directions
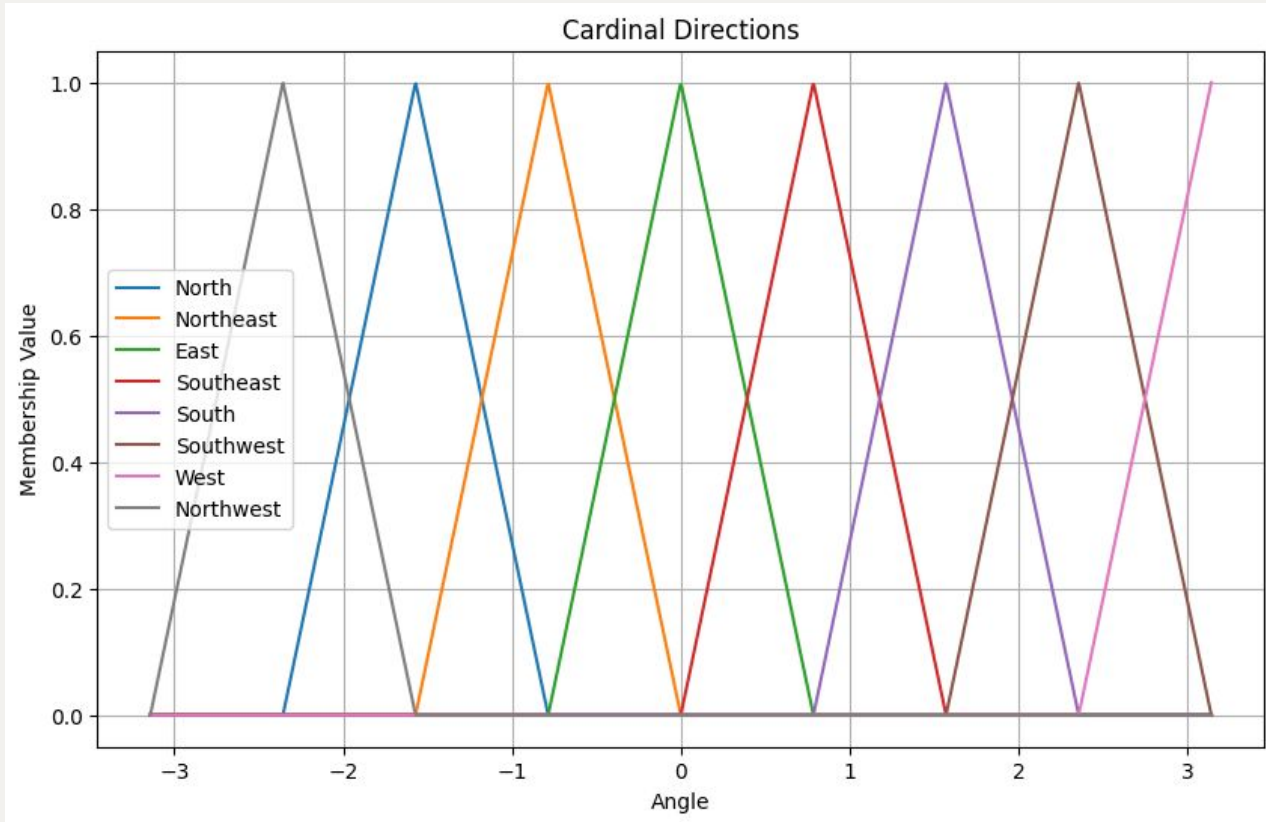
Gaussian Approach:

Representation:

Results

Frm	Track	xc	yc	w	h	Velocity(kr	dx	dy
1	13	1826	1383	36	94	0		
2	13	1826	1381	37	92	5.810927	0	-2
3	13	1827	1377	36	92	11.97759	1	-4
4	13	1827	1373	36	92	12.74722	0	-4
5	13	1828	1367	37	91	17.10052	1	-6
6	13	1828	1362	37	91	16.99813	0	-5
7	13	1828	1359	37	93	13.78322	0	-3
8	13	1828	1356	37	93	11.87738	0	-3
9	13	1829	1352	37	93	12.04038	1	-4
10	13	1830	1349	38	95	11.08181	1	-3

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Results
Gaussian

Frm	Track	xc	yc	w	h	Velocity(kr	dx	dy	angle	N	NE	E	SE	S	SW	W	NW	direction
1	13	1826	1383	36	94	0												
2	13	1826	1381	37	92	5.810927	0	-2	-1.5708	0.999994	0.606531	0.135338	0.01111	0.000335	3.73E-06	1.52E-08	0.606531	N
3	13	1827	1377	36	92	11.97759	1	-4	-1.32582	0.952513	0.789202	0.240556	0.026975	0.001113	1.69E-05	9.43E-08	0.422926	N
4	13	1827	1373	36	92	12.74722	0	-4	-1.5708	0.999994	0.606531	0.135338	0.01111	0.000335	3.73E-06	1.52E-08	0.606531	N
5	13	1828	1367	37	91	17.10052	1	-6	-1.40565	0.978135	0.732103	0.201582	0.020419	0.000761	1.04E-05	5.26E-08	0.480763	N
6	13	1828	1362	37	91	16.99813	0	-5	-1.5708	0.999994	0.606531	0.135338	0.01111	0.000335	3.73E-06	1.52E-08	0.606531	N
7	13	1828	1359	37	93	13.78322	0	-3	-1.5708	0.999994	0.606531	0.135338	0.01111	0.000335	3.73E-06	1.52E-08	0.606531	N
8	13	1828	1356	37	93	11.87738	0	-3	-1.5708	0.999994	0.606531	0.135338	0.01111	0.000335	3.73E-06	1.52E-08	0.606531	N
9	13	1829	1352	37	93	12.04038	1	-4	-1.32582	0.952513	0.789202	0.240556	0.026975	0.001113	1.69E-05	9.43E-08	0.422926	N
10	13	1830	1349	38	95	11.08181	1	-3	-1.24905	0.919509	0.840088	0.282359	0.034913	0.001588	2.66E-05	1.64E-07	0.37025	N

Triangular

Frm	Track	xc	yc	w	h	Velocity(kr	dx	dy	angle	N	NE	E	SE	S	SW	W	NW	direction
1	13	1826	1383	36	94	0												
2	13	1826	1381	37	92	5.810927	0	-2	-1.5708	0.996997	0.001502	0	0	0	0	0	0.001502	N
3	13	1827	1377	36	92	11.97759	1	-4	-1.32582	0.688083	0.311917	0	0	0	0	0	0	N
4	13	1827	1373	36	92	12.74722	0	-4	-1.5708	0.996997	0.001502	0	0	0	0	0	0.001502	N
5	13	1828	1367	37	91	17.10052	1	-6	-1.40565	0.789726	0.210274	0	0	0	0	0	0	N
6	13	1828	1362	37	91	16.99813	0	-5	-1.5708	0.996997	0.001502	0	0	0	0	0	0.001502	N
7	13	1828	1359	37	93	13.78322	0	-3	-1.5708	0.996997	0.001502	0	0	0	0	0	0.001502	N
8	13	1828	1356	37	93	11.87738	0	-3	-1.5708	0.996997	0.001502	0	0	0	0	0	0.001502	N
9	13	1829	1352	37	93	12.04038	1	-4	-1.32582	0.688083	0.311917	0	0	0	0	0	0	N
10	13	1830	1349	38	95	11.08181	1	-3	-1.24905	0.590334	0.409666	0	0	0	0	0	0	N

Results

angle	N	NE	E	SE	S	SW	W	NW	direction
0.321751	0	0	0.590334	0.409666	0	0	0	0	E
0.197396	0	0	0.748668	0.251332	0	0	0	0	E
0.083141	0	0	0.894141	0.105859	0	0	0	0	E
0.44752	0	0	0.4302	0.5698	0	0	0	0	SE
0.2783	0	0	0.645658	0.354342	0	0	0	0	E
0.165149	0	0	0.789726	0.210274	0	0	0	0	E
0.358771	0	0	0.543199	0.456801	0	0	0	0	E
0.197396	0	0	0.748668	0.251332	0	0	0	0	E
0.218669	0	0	0.721582	0.278418	0	0	0	0	E
0.218669	0	0	0.721582	0.278418	0	0	0	0	E
0.099669	0	0	0.873098	0.126902	0	0	0	0	E
0.463648	0	0	0.409666	0.590334	0	0	0	0	SE
0.982794	0	0	0	0.748668	0.251332	0	0	0	SE
0.218669	0	0	0.721582	0.278418	0	0	0	0	E
0.519146	0	0	0.339003	0.660997	0	0	0	0	SE
0.380506	0	0	0.515524	0.484476	0	0	0	0	E
0.558599	0	0	0.288769	0.711231	0	0	0	0	SE
0.463648	0	0	0.409666	0.590334	0	0	0	0	SE
0.463648	0	0	0.409666	0.590334	0	0	0	0	SE
0.463648	0	0	0.409666	0.590334	0	0	0	0	SE

Summary ,conclusion and future work

- Fuzzy logic helps to figure out the direction of vehicle accurately.

- Applying the approach would make traffic control and self driving cars better.

- The flexibility of fuzzy logic of applying it on real time scenario makes it more efficient.

- Hence it would make transportation systems more efficient and safer.

- To increase the uses, we can apply machine learning models to the outputs.

- To visualize the predictions, we can plot that predicted direction on the image.

References

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