drones

MDPI

Flying Free: A Research Overview of Drone Navigation Autonomy

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Table S1. Drone Autonomy Research Overview Rubric Sorted by Number of Citations/ Year.

			Performance (at given task)			Awareness			Basic Navigation			Advanced Navigation			Engineering		
Paper	**Cit**	**Year**	**F1**	**Accuracy**	**Efficiency**	**SE**	**ODe**	**ODi**	**AM**	**CA**	**ATL**	**PG**	**ED**	**NPM**	**OBP**	**ES**	**SI**
A.Loquercio et al.	34	2020				No	No	**Yes**	**Yes**	**Yes**	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**
M.K.Al Sharman et al.	11	2020				No	No	No	No	**Yes**	No	No	No	No	No	**Yes**	No
S.Nezami et al.	8	2020		98.3%		No	No	**Yes**	No	No	No	No	**Yes**	No	No	No	No
H.Shiri et al.	6	2020				No	No	No	No	No	No	**Yes**	No	No	No	No	No
K.Lee et al.	6	2020			80ms	No	No	No	**Yes**	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No
A.Anwar et al.	5	2020				No	No	No	**Yes**	**Yes**	No	No	No	No	No	**Yes**	No
R.Chew et al.	4	2020	0.86	86.0%		No	No	**Yes**	No	No	No	No	**Yes**	No	No	**Yes**	No
I.Roldan et al.	4	2020		99.5%		No	No	**Yes**	No	No	No	No	No	No	No	**Yes**	No
Y.Liao et al.	3	2020		97.8%		**Yes**	No	**Yes**	No	No	No	No	No	No	No	**Yes**	No
Y.Wang et al.	1	2020				No	**Yes**	No	**Yes**	**Yes**	No	**Yes**	No	No	No	No	No
I.Bozcan et al.	1	2020	0.9907			No	No	**Yes**	No	No	No	No	No	No	No	No	No
L.Messina et al.	1	2020				**Yes**	No	No	**Yes**	**Yes**	No	No	No	No	No	**Yes**	No
B.Li et al.	0	2020		90.0%		No	No	**Yes**	No	No	No	No	No	No	No	**Yes**	No
J.Tan et al.	0	2020	0.8886	90.0%		No	No	No	No	**Yes**	No	No	No	No	No	No	No
M.Gao et al.	0	2020				No	No	No	No	No	No	**Yes**	No	No	No	**Yes**	No
R.Yang et al.	0	2020		96.0%		No	No	**Yes**	No	No	No	No	No	No	No	**Yes**	No
K.Menfoukh et al.	0	2020	0.85	91.0%		No	No	**Yes**	**Yes**	**Yes**	No	No	No	No	No	**Yes**	No
V.Sadhu et al.	0	2020				No	No	**Yes**	No	No	No	No	No	No	No	No	No
R.Raman et al.	0	2020				No	No	No	No	**Yes**	No	No	No	No	No	**Yes**	No
B.Hosseiny et al.	0	2020	0.855	90.9%		No	No	**Yes**	No	No	No	No	**Yes**	No	No	**Yes**	No
R.I.Marasigan et al.	0	2020				No	No	No	No	No	No	No	No	No	**Yes**	**Yes**	No
M.Irfan et al.	0	2020				**Yes**	No	No	**Yes**	**Yes**	No	No	No	No	No	No	No
V.A.Bakale et al.	0	2020			92s	**Yes**	**Yes**	No	No	**Yes**	No	**Yes**	No	No	No	**Yes**	No
L.O.Rojas Perez et al.	0	2020			25.4ms	No	No	**Yes**	**Yes**	**Yes**	No	No	No	**Yes**	No	**Yes**	No
D.Wofk et al.	55	2019		77.1%	37ms	**Yes**	No	No	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**

E.Kaufmann et al.	50	2019			100ms	No	No	**Yes**	**Yes**	**Yes**	No	**Yes**	No	**Yes**	**Yes**	**Yes**	**Yes**
D.Palossi et al.	43	2019	0.821	89.1%	55.5ms	**Yes**	**Yes**	No	**Yes**	**Yes**	No	No	No	No	**Yes**	**Yes**	**Yes**
Hossain et al.	19	2019				No	No	**Yes**	No	No	No	No	No	No	**Yes**	**Yes**	**Yes**
Y.Y.Munaye et al.	11	2019		98.0%		No	No	**Yes**	No	No	No	No	No	No	No	**Yes**	No
S.Islam et al.	9	2019		80.0%		No	No	No	No	**Yes**	No	**Yes**	No	No	No	No	No
A.Alshehri et al.	8	2019		80.2%		No	No	**Yes**	No	No	No	No	No	No	No	**Yes**	No
M.A.Akhloufi et al.	8	2019			33ms	No	No	**Yes**	**Yes**	No	No	No	No	**Yes**	No	**Yes**	No
A.G.Perera et al.	6	2019		75.9%		No	No	**Yes**	No	No	No	No	No	No	No	**Yes**	No
X.Han et al.	4	2019		88.0%		No	No	No	No	**Yes**	No	No	No	No	no	No	No
D.R.Hartawan et al.	4	2019		100.0%	330ms	No	No	**Yes**	No	No	No	No	**Yes**	No	No	**Yes**	No
G.Muñoz et al.	4	2019				No	No	No	**Yes**	**Yes**	No	No	No	**Yes**	No	**Yes**	No
Mohammadi et al.	4	2019				**Yes**	No	**Yes**	No	No	No	No	No	No	No	**Yes**	No
A.Garcia et al.	3	2019		98.0%	45ms	No	No	No	**Yes**	**Yes**	No	No	No	No	No	**Yes**	No
S.Shin et al.	3	2019				No	**Yes**	No	**Yes**	**Yes**	No	No	No	**Yes**	No	**Yes**	No
S.Y.Shin et al.	2	2019				**Yes**	No	No	**Yes**	**Yes**	No	**Yes**	No	**Yes**	No	No	No
A.Garcia et al.	1	2019				No	No	**Yes**	**Yes**	**Yes**	No	No	No	No	No	**Yes**	No
L.Liu et al.	1	2019				No	No	**Yes**	No	No	No	**Yes**	No	No	No	No	No
J.A.Cocoma Ortega et al.	0	2019		95.0%		No	No	**Yes**	**Yes**	**Yes**	No	No	No	No	**Yes**	**Yes**	**Yes**
M.T.Matthews et al.	0	2019				No	No	No	**Yes**	No	No	No	No	No	No	**Yes**	No
J.Morais et al.	0	2019				No	No	No	**Yes**	No	No	**Yes**	No	No	No	**Yes**	No
A.Garrell et al.	0	2019		75.8%		No	No	**Yes**	**Yes**	**Yes**	No	No	No	No	No	**Yes**	No
E.Cetin et al.	0	2019				No	No	No	**Yes**	**Yes**	No	No	No	No	No	**Yes**	No
A.Loquercio et al.	158	2018	0.901	95.4%	50ms	**Yes**	**Yes**	No	**Yes**	**Yes**	No	No	No	No	No	**Yes**	No
E.Kaufmann et al.	60	2018			100ms	No	No	**Yes**	**Yes**	**Yes**	No	No	No	No	**Yes**	**Yes**	**Yes**
O.Csillik et al.	58	2018	0.9624	96.2%		No	No	**Yes**	No	No	No	No	**Yes**	No	No	**Yes**	No
S.Jung et al.	57	2018		75.5%	34ms	No	No	**Yes**	**Yes**	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**
A.A.Zhilenkov et al.	23	2018				**Yes**	No	No	**Yes**	**Yes**	No	No	**Yes**	No	**Yes**	**Yes**	**Yes**
S.Lee et al.	14	2018				No	No	**Yes**	No	No	**Yes**	No	No	**Yes**	**Yes**	**Yes**	**Yes**
S.Dionisio Ortega et al.	14	2018				No	**Yes**	No	**Yes**	**Yes**	No	No	**Yes**	No	No	**Yes**	No
Y.Feng et al.	13	2018				No	No	**Yes**	No	No	**Yes**	No	No	**Yes**	No	**Yes**	No
N.Mohajerin et al.	13	2018				No	No	No	**Yes**	No	No	No	No	No	No	**Yes**	**Yes**
A.Carrio et al.	13	2018		98.0%	50ms	No	No	No	No	No	**Yes**	No	No	No	No	No	No
A.Rodriguez Ramos et al.	12	2018		78.6%		No	No	**Yes**	**Yes**	No	**Yes**	No	**Yes**	**Yes**	No	**Yes**	No
M.Jafari et al.	11	2018				No	No	No	No	**Yes**	No	No	No	No	No	**Yes**	No

M.A.Anwar et al.	11	2018				**Yes**	**Yes**	No	**Yes**	**Yes**	No	No	No	No	No	**Yes**	No
A.Khan et al.	10	2018		78.0%		No	No	No	**Yes**	**Yes**	No	**Yes**	No	No	No	**Yes**	No
Y.Xu et al.	7	2018				No	No	**Yes**	No	No	**Yes**	No	No	**Yes**	No	**Yes**	No
I.A.Sulistijono et al.	6	2018		84.1%	450ms	No	No	**Yes**	No	No	No	No	No	No	No	**Yes**	No
J.Shin et al.	6	2018				**Yes**	No	No	No	No	No	No	No	No	No	**Yes**	No
S.P.Yong et al.	5	2018	0.731	97.3%		No	No	**Yes**	No	No	No	No	**Yes**	No	No	**Yes**	**Yes**
C.Beleznai et al.	3	2018			50ms	**Yes**	No	**Yes**	No	No	No	No	No	No	**Yes**	No	**Yes**
H.U.Dike et al.	3	2018		86.5%	86.6ms	No	No	**Yes**	No	No	No	No	No	No	No	**Yes**	**Yes**
X.Guan et al.	3	2018				**Yes**	No	No	No	**Yes**	No	No	No	No	No	No	No
Y.Liu et al.	3	2018				No	No	No	No	**Yes**	No	No	No	No	No	**Yes**	No
X.Dai et al.	1	2018				No	No	No	No	**Yes**	No	No	No	No	No	No	No
J.M.S Lagmay et al.	1	2018				No	No	No	**Yes**	**Yes**	No	No	No	No	No	**Yes**	No
X.Chen et al.	0	2018		95.0%	50ms	No	No	No	No	**Yes**	**Yes**	No	No	**Yes**	No	No	No
D.Gandhi et al.	165	2017				No	**Yes**	No	**Yes**	**Yes**	No	No	No	No	No	**Yes**	No
D.Falanga et al.	98	2017		80.0%	0.24ms	No	No	No	**Yes**	**Yes**	No	**Yes**	No	**Yes**	**Yes**	No	**Yes**
K.McGuire et al.	88	2017				**Yes**	No	No	**Yes**	**Yes**	No	No	No	No	**Yes**	No	**Yes**
A.Zeggada et al.	43	2017		82.7%	39ms	No	No	**Yes**	No	No	No	No	No	No	No	**Yes**	No
Y.Zhao et al.	31	2017				No	No	No	No	No	No	**Yes**	No	No	No	No	No
L.Von et al.	25	2017				**Yes**	**Yes**	No	No	No	No	No	No	No	No	No	No
P.Moriarty et al.	11	2017		98.5%		No	No	**Yes**	No	No	**Yes**	No	**Yes**	**Yes**	No	**Yes**	No
Y.F.Teng et al.	11	2017				No	No	No	No	No	No	No	No	No	No	No	No
Y.Zhou et al.	3	2017				No	No	No	No	**Yes**	No	No	No	No	No	No	No
A.Garcia et al.	3	2017		90.0%		**Yes**	No	No	**Yes**	No	No	No	No	No	No	**Yes**	No
Y.Choi et al.	1	2017		98.9%		No	No	**Yes**	No	No	No	No	No	**Yes**	No	No	No
Y.Zhang et al.	1	2017		83.0%		No	**Yes**	**Yes**	No	No	No	No	No	No	No	**Yes**	No
S.Andropov et al.	0	2017				No	No	No	**Yes**	No	No	No	No	No	No	**Yes**	No
A.Giusti et al.	424	2016				No	No	**Yes**	**Yes**	**Yes**	No	No	No	No	No	**Yes**	No
T.Zhang et al.	263	2016				No	No	No	**Yes**	**Yes**	No	No	No	No	**Yes**	**Yes**	No
S.Daftry et al.	26	2016		78.0%		**Yes**	No	No	**Yes**	**Yes**	No	No	No	No	No	No	No
M.E.Antonio Toledo et al.	3	2016				No	No	No	No	No	No	**Yes**	No	**Yes**	No	**Yes**	No

Author's Note: For the sake of readability, the various features in each section have been abbreviated in line with the display tables in the research overview, the legend for these abbreviations can be found in Table S2 below, further definition of these features are found in Section 2 and Section 3 of the main text.

Table S2. Abbreviation legend for Autonomous Features.

Awareness		**Basic Navigation**		**Expanded Navigation**		**Engineering**	
Abbrev.	**Feature**	**Abbrev.**	**Feature**	**Abbrev.**	**Feature**	**Abbrev.**	**Feature**
SE	Spatial Evaluation	AM	Autonomous Movement	PG	Path Generation	OBP	On Board Processing
ODe	Object Detection	CA	Collision Avoidance	ED	Environmental Distinction	ES	Extra Sensory

ODi	Object Distinction	ATL	Auto Take off/Landing	NPM	Non Planar Movement	SI	Signal Independent