



Data-driven Conflict Detection Enhancement in Closest Point of Approach Problem

Zhengyi Wang, Man Liang, Daniel Delahaye

► To cite this version:

Zhengyi Wang, Man Liang, Daniel Delahaye. Data-driven Conflict Detection Enhancement in Closest Point of Approach Problem. SID 2019, 9th SESAR Innovation Days, Dec 2019, Athenes, Greece. hal-02388307v2

HAL Id: hal-02388307

<https://enac.hal.science/hal-02388307v2>

Submitted on 15 Dec 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Data-driven Conflict Detection Enhancement with Machine Learning

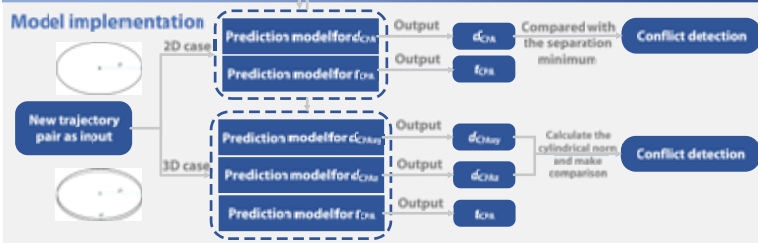
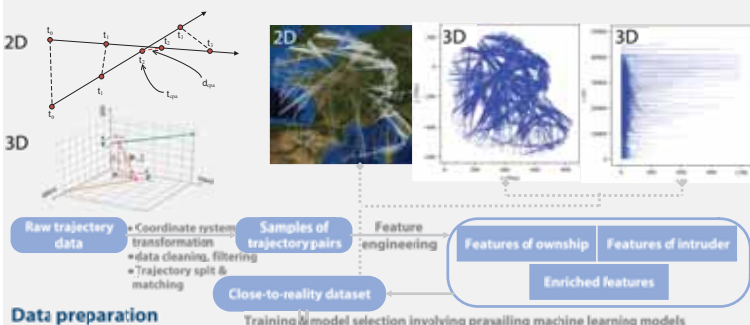
Objective:

To propose a novel data-driven conflict detection framework with machine learning for performance enhancement in actual operations.

Methodology:

Closest Point of Approach (CPA): Positions at which two dynamically moving objects reach their closest possible distance. It is a key concept in the algorithmic level for conflict detection.

Main problem of conventional model: Assumption cannot be ensured in real operations.



Results:

CPA prediction

2D case:

Models	$d_{CPA}(Nm)$		$t_{CPA}(s)$	
	MAE	RMSE	MAE	RMSE
Baseline	3.76	8.09	83.05	766.31
FFNNs	22.23	34.36	227.71	280.63
KNN	6.20	10.26	98.44	194.12
GBM	1.96	3.31	41.40	80.33
RF	2.79	10.49	76.11	122.11
GBM	0.42	2.83	28.81	45.66
RF	2.14	4.20	94.26	12.28

3D case:

Models	$d_{CPA_{3D}}(Nm)$		$d_{CPA}(B)$		$t_{CPA}(s)$	
	MAE	RMSE	MAE	RMSE	MAE	RMSE
Baseline	4.52	9.63	29.01	203.3	42.73	67.83
FFNNs	0.30	0.56	9.32	66.85	3.83	13.05
KNN	1.56	2.13	12.88	95.96	13.67	30.85
GBM	0.20	0.43	7.35	49.22	4.63	13.39
RF	0.51	0.80	20.13	90.22	5.08	15.24

Conflict detection

Models	TP		FN		TN		FP	
	Num	Rate	Num	Rate	Num	Rate	Num	Rate
Baseline	6359	92.15%	542	7.85%	10293	95.81%	450	4.19%
FFNNs	6551	94.93%	350	5.07%	10377	96.59%	366	3.41%
KNN	5720	83.02%	1172	16.98%	9852	91.71%	891	8.29%
GBM	6673	96.70%	228	3.30%	10517	97.90%	226	2.10%
RF	6514	94.39%	387	5.61%	10418	96.97%	325	3.02%

Models	TP		FN		TN		FP	
	Num	Rate	Num	Rate	Num	Rate	Num	Rate
Baseline	18543	72.62%	6992	27.38%	221191	99.35%	1453	0.65%
FFNNs	24088	94.33%	1447	5.67%	222148	99.78%	496	0.22%
KNN	18742	73.40%	6793	26.60%	217772	97.81%	4872	2.19%
GBM	24914	97.57%	621	2.43%	214018	96.13%	8626	3.87%
RF	23917	93.37%	1618	6.34%	212627	95.50%	10017	4.50%

* TP: True Positive FN: False Negative TN: TrueNegative FP: False Positive

ZhengyiWang¹
zhengyi.wang@enac.fr

¹Ecole Nationale de l'Aviation Civile

Man Liang²
annie.liang@urisa.edu.au

²University of South Australia

Daniel Delahaye¹
delahaye@recherche.enac.fr

