



Machine Learning demonstrator

Deliverable ID:	D3.2
Dissemination Level:	Public
Project Acronym:	MAHALO
Grant:	892970
Call:	H2020-SESAR-2019-2
Topic:	SESAR-ER4-01-2019
Consortium Coordinator:	DBL
Edition Date:	21 February 2022
Edition:	00.02.00
Template Edition:	02.00.02

Founding Members



EUROPEAN UNION EUROCONTROL





Authoring & Approval

Authors of the document

Name/Beneficiary	Position/Title	Date
Magnus Bång (LiU)	WP3 Leader	04.08.21

Reviewers internal to the project

Name/Beneficiary	Position/Title	Date
Carl Westin (LiU)	WP6 Leader	04.08.21
Brian Hilburn (CHPR)	WP2 Leader	04.08.21
Clark Borst	WP4 Leader	04.08.21
Martin Christiansson (LFV)	Project member	04.08.21
Matteo Cocchioni (DBL)	Project Contributor	04.08.21

Approved for submission to the SJU By - Representatives of beneficiaries involved in the project

Name/Beneficiary	Position/Title	Date
Stefano Bonelli (DBL)	Project Coordinator	06.08.21
Stefano Bonelli (DBL)	Project Coordinator	21.02.22

Rejected By - Representatives of beneficiaries involved in the project

Name/Beneficiary	Position/Title	Date
------------------	----------------	------



Document History

Edition	Date	Status	Author	Justification
00.00.01	04.08.21	Doc created	Magnus Bång	Proposed structure of demonstration movie
00.01.00	06.08.21	Final Release	Stefano Bonelli	Deliverable approved for submission to the SJU
00.01.01	14.02.22	Internal Release	Matteo Cocchioni	Deliverable revision
00.02.00	21.02.22	Final Release	Stefano Bonelli	Deliverable approved for submission to the SJU

Copyright Statement

© – 2022 – MAHALO Consortium. All rights reserved. Licensed to the SESAR Joint Undertaking under conditions.



MAHALO

MODERN ATM VIA HUMAN / AUTOMATION LEARNING OPTIMISATION

This deliverable is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 892970 under European Union's Horizon 2020 research and innovation programme.



Abstract

Deliverable D3.2 demonstrates two machine learning models developed in WP3, in the MAHALO project, representing two distinct approaches to automation support. Consequently - supplementing D3.1 – the demonstrator shows our approach to investigate questions on *conformance* and *transparency* in terms of one machine learning model based on *Supervised Learning* to replicate human problem-solving strategies and one model using *Reinforcement Learning* to provide explanations to the human operator. These models are to be used in the subsequent human-in-the-loop experiments with air traffic controllers at a later stage in MAHALO. The content was set together by Linköping University, TU Delft and CHPR.



Table of Contents

Abstract	4
1 Introduction and scope	6
ACRONYMS	7





1 Introduction and scope

The purpose of *D3.2 – Machine Learning demonstrator* is to be a standalone deliverable which presents the software realization of the hybrid ML model. Since this is intended for demonstration purposes only, it has been realised as a playback only, non-interactive presentation.

It should be watched in parallel with *D3.1 – Machine Learning report*, which documents the development and tuning of the component Supervised Learning and Reinforcement Learning, their integration into a hybrid ML system, the synthetic traffic generator capability, HITL runs, and analysis of both ML system performance and participant subjective data.

The outcome of D3.2 is the demonstrator itself. Once it is approved, the video will be published and sponsored in the main MAHALO communication channels, for dissemination purposes.

The demonstrator could be found at the following link:

<https://drive.google.com/drive/folders/18TWcpwUO7ACHLG99FVT9eAoxsgHG5rCu?usp=sharing>



ACRONYMS

AI	Artificial Intelligence
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATM	Air Traffic Management
CD&R	Conflict Detection and Resolution
DDPG	Deep Deterministic Policy Gradient
DQfD	Deep Q-learning from Demonstrations
DQN	Deep Q-Network (or Deep Q-learning)
EPOG	Eye Point of Gaze
HITL	Human in the Loop
LOS	Loss of Separation
MAHALO	Modernising ATM via Human-Automation Learning Optimisation
ML	Machine Learning
MUAC	Maastricht Upper Airspace Centre
RL	Reinforcement Learning
SL	Supervised Learning
SSD	Solution Space Diagram
WP	Work Package