



MALORCA 2nd Stakeholder Meeting

MALORCA brings together Automatic Speech Recognition and Machine Learning

Hon. Prof. Hartmut Helmke

Vienna, 20th to 21st of February 2018





Abstract

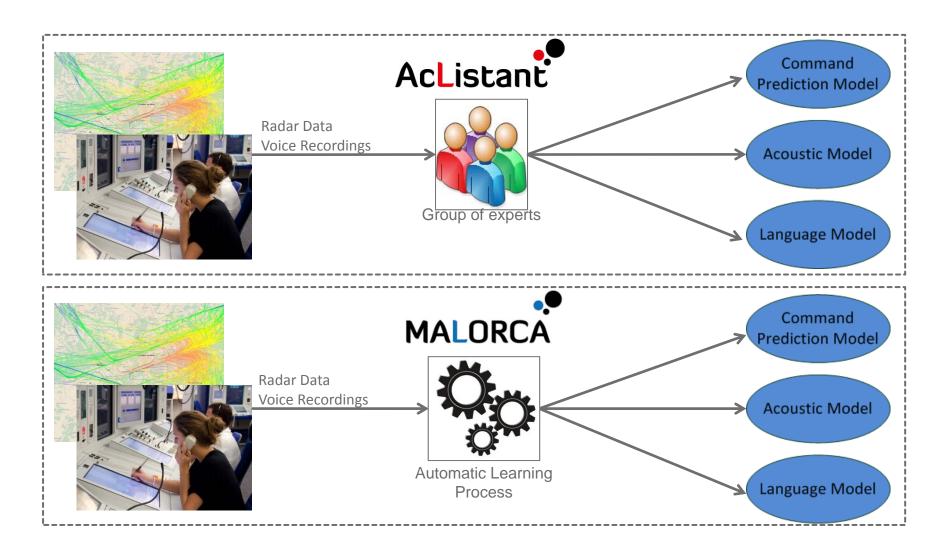


The presentation gives an overview of MALORCA project and its partners. The different roadmaps of Automatic Speech Recognition on the one hand and Machine Learning on the other hand are presented.

Furthermore the agenda of the two days including logistic information is presented.

Motivation – The MALORCA Project





MALORCA's First Stakeholder Workshop April 17 SESAR





MALORCA's First Stakeholder Workshop April 17





MALORCA's First Stakeholder Workshop April 17





MALORCA's First Stakeholder Workshop April 17





One Result of First Workshop



Split the Workshop into two half days

→ To have the evening for deeper discussions

Main Result of First Workshop



We have 2 different roadmaps

- Roadmap of Automatic Speech Recognition
- Roadmap of Machine Learning



MALORCA

- focuses on Machine Learning
- With Automatic Speech Recognition as one ATC example
- Next we can e.g. apply Machine Learning also on adapting an Arrival Manager by Machine Learning
- Adaptation by Learning instead of Programming/Configuration

Roadmap for Machine Learning in ATC





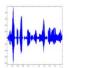
2010 2019 2022 2023	2016	2019	2022	2025
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Learning algorithms to reduce costs for voice recognition

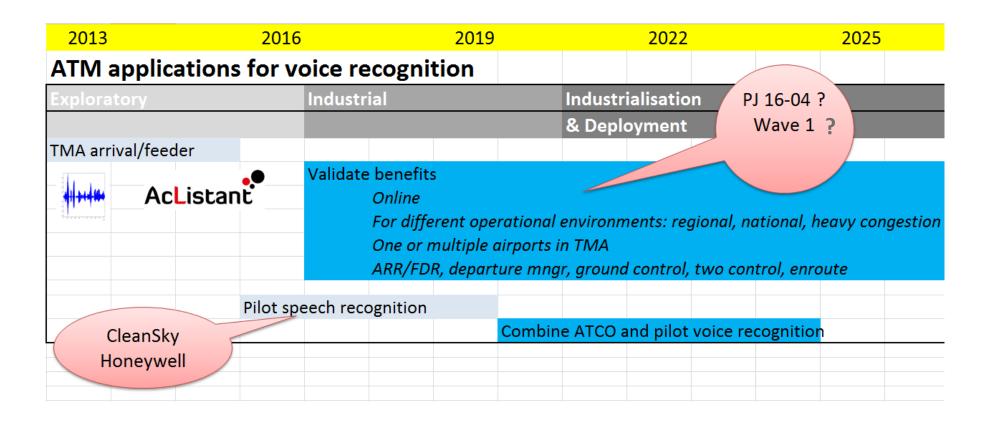
Exploratory		Industrial	Industrialisation
			& Deployment
accents, spe	eaking styles,		2146.242
chang	ges in vocabu	lary,	PJ 16-04 ?
phras	eology local/	personal patt	terns Wave 2 ?
••	airspace stru	ucture	
MALORCA	ing		
		Performance in col	omplex environment like London?
		Input for datalink a	

Roadmap for Automatic Speech Recognition









MALORCA objectives





ASR and ABSR related objectives

- Provide tools to develop ABSR system for different deployment areas
- Proof of concept and roadmap for automatic adaptation of ASR in ATC
- Show cases are Prague and Vienna
- Improvement of command error/recognition rate by machine learning

MALORCA objectives (2)





Machine learning related objectives

- Develop a multi-modal, state-of-the-art, automatic learning system for ABSR
- Automatic Learning from radar data and voice recordings
 - To reduce costs of data
 - To speed up development
 - To reduce manual adaptation effort

MALORCA objectives (4)



Bringing together **experts from multiple disciplines**, i.e. experts

- from data science, machine learning, (Idiap, USAAR)
- speech processing and recognition and (Idiap, USAAR)
- air traffic control (DLR, Austro Control, ANS CR)

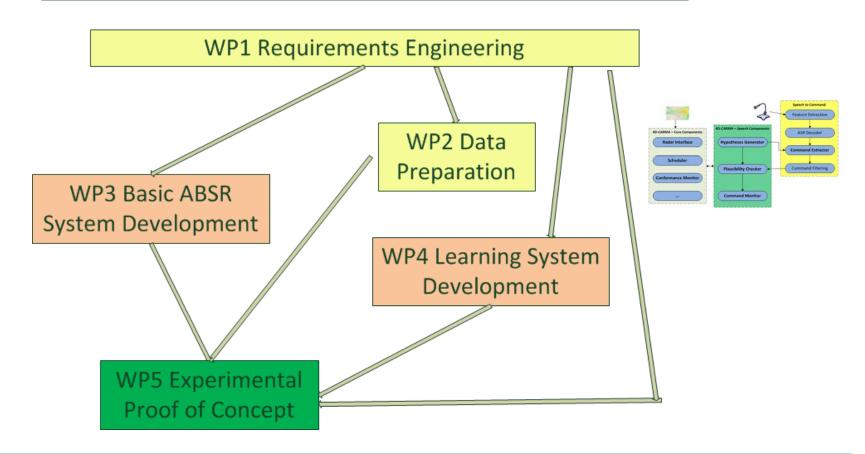
Best Proof, however, workshop 1 and today!!!

Work Break Down Structure



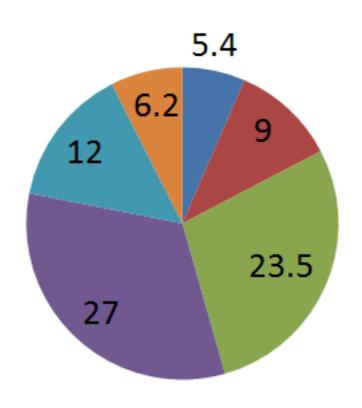
Project Start: April 2016
Project End: March 2018

WP6: Project Management, Dissemination and Exploitation



Total Budget and Effort





Total: 83.1 PM

538 k€ plus 208 kCHF

- Requierements Engineering
- Data Preparation
- Basic ASR System
- Machine Learning
- Proof of Concept
- Management, Deployment

DLR: Locations and employees

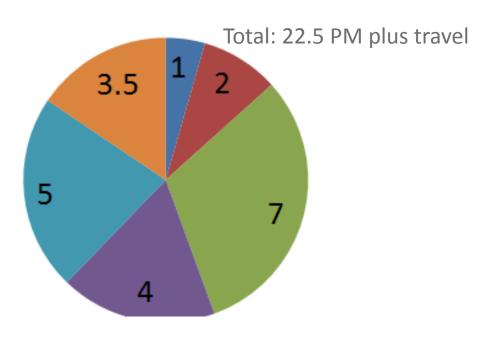
Approx. 8000 employees across 40 institutes and facilities at 20 sites. Offices in Brussels, Paris, Tokyo and Washington.

Institute of Flight Guidance in Braunschweig with 140 employees Controller Assistance Department involved in MALORCA



DLR





- Requierements Engineering
- Data Preparation
- Basic ASR System
- Machine Learning
- Proof of Concept
- Management, Deployment

Main contributions to MALORCA:

- Radar Data Preparation
- Voice Utterance Preparation
- Command Hypotheses Prediction
- Learning of Command Hypotheses Prediction Model (CPM)
- Proof-of-Concept
- Dissemination & Management
- Ethical Issues

USAAR: Universität des Saarlandes



- University-Budget: 160M€
- 16000 Students
- Strength: computer science
- Associated institutes like
 DFKI, MPI-I, MPI-SWS, CISPA
- Cluster of Excellence Multimodal Computing
- Center on Information Density
- Spoken Language Systems Group:
 - Speech Recognition, Information Extraction, Dialog Systems
 - Top performance in international benchmarks













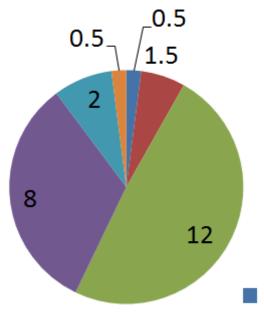




USAAR



Total: 24.5 PM plus travel



Main contributions in MALORCA:

- Development of Basic ABSR system, easy adaptable to new airports by ML techniques
- Development of Machine Learning Algorithms
- Requierements Engineering
- Data Preparation
- Basic ASR System
- Machine Learning
- Proof of Concept
- Management, Deployment

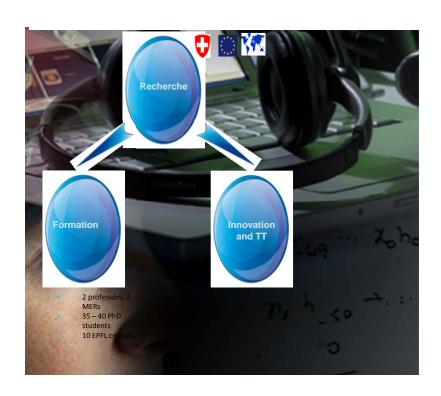


Artificial Intelligence for Society





- Statutes (1991): Independent, not-for-profit, Research Foundation
- Areas of activity: multilingual and multimodal interaction and multimedia information management, human behavior modeling
- Academic affiliation: EPFL (+Joint Development Plan, since July 2008) and University of Geneva
- **Budget**: around 10+ MCHF, **Staff**: 120+ (+50 across 16 start-ups)
- **Public funding**: 40%, **Competitive funding**: 60% of total funding, Active in numerous research programs/projects (CH, EU, US/DARPA, industry)





SPEECH AND AUDIO PROCESSING Prof. Hervé Bourlard



SOCIAL COMPUTING
Prof. Daniel Gatica-Perez



COMPUTER VISION AND LEARNING Dr François Fleuret



PERCEPTION AND
ACTIVITY
UNDERSTANDING
Dr Jean-Marc Odobez



ROBOT LEARNING AND INTERACTION Dr Sylvain Calinon



UNCERTAINTY
QUANTIFICATION AND
OPTIMAL DESIGN
Dr David Ginsbourger



COMPUTATIONAL BIOIMAGING Dr Michael Liebling



BIOMETRIC PERSON RECOGNITION Dr Sébastien Marcel

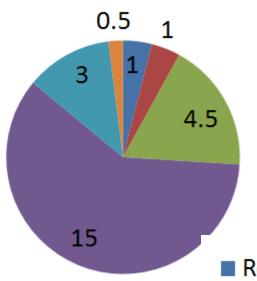


NATURAL LANGUAGE
PROCESSING
Dr Andrei Popescu-Belis

Idiap







Main contributions in MALORCA:

- Development of Basic ABSR system, easy adaptable to new airports by ML techniques
- Development of Machine Learning Algorithms
- Requierements Engineering
- Data Preparation
- Basic ASR System
- Machine Learning
- Proof of Concept
- Management, Deployment

Austro Control



FUNCTIONS OF AUSTRO CONTROL

Austro Control has two main functions, performed by separate divisions.

The Air Navigation Services Division largely comprises operational functions, while the Aviation Agency is responsible for regulatory matters.

Air Navigation Services (ANS):

- Air Traffic Management
- Aeronautical information management
- ATS engineering (e.g. radar)
- Aviation weather service
- Academy

Aviation Agency (LFA):

- Airworthiness and Certification
- · Supervision of aircraft maintenance
- Search and Rescue (SAR)
- Supervision of aviation schools
- Pilots' licenses

Austro Control



SAFETY IS IN THE AIR

Austro Control is one of Europe's leading air traffic control organisations. There are as many as <u>4,000 controlled flights</u> in Austrian airspace on some days. With a <u>workforce of about 1,000</u>, Austro Control's key task is maintaining safe, punctual, efficient and environmentally friendly air traffic round the clock, 365 days a year, with over 1 million flight movements in Austrian airspace.

Austro Control is a limited company (plc) owned by the Austrian government that grew from the Federal Office of Civil Aviation (corporatised on 1 January 1994). The company received Single European Sky certification in December 2006, and is thus entitled in principle to provide air traffic control services throughout the EU.

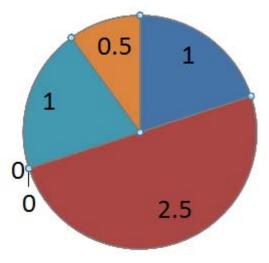
Austro Control



Main duties in MALORCA:

- Operational Concept Description
- Consolidation of System Requirements
- Provide recorded Vienna Approach
 Speech Data
 - 10 hours net including transcription
 - 100 hours gross
- Provide Controllers for Feedback-Sessions
- Dissemination

Total: 63 k€ plus travel



Total: 5 PM plus travel

- Requierements Engineering
- Data Preparation
- Basic ASR System
- Machine Learning
- Proof of Concept
- Management, Deployment

ANS CR Company profile



- ANS CR (Air Traffic Services of the Czech Republic, state enterprise):
 - Location: IATCC Jenec
- ANS CR state enterprise provides public <u>Air Traffic Services</u> in the airspace of the Czech Republic, at Prague Airport and 3 regional Airports of Brno, Ostrava and Karlovy Vary. En route services are provided as integrated with the MIL.
- ANS CR provides specialized <u>aviation training in its own Training Centre of ANS CR/Czech Air Navigation Institute (CANI)</u> and offers also the training for pilots in its subsidiary company the Czech Aviation Training Centre (CATC) on aircraft simulators, both units being part of the Aviation Academy Group.
- The part of **ANS CR** organization is the Flight Inspection Service Unit providing the flight checking within Czech Airspace as well as outside on a commercial basis.
- ANS CR is a member of the FAB Central Europe (FAB CE).
- ANS CR is constituent entity of <u>B4 Consortium</u>.

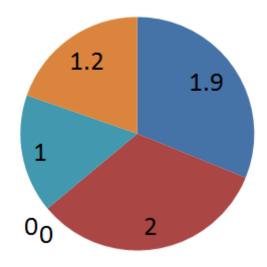
ANS CR SESAR2020 Involvement



Project / Key Feature	Solution				
"Advanced Air Traffic Services"					
PJ.01 Enhanced Arrivals & Departures	PJ.01-02 Use of Arrival and Departure Management Information for Traffic Optimisation within the TMA				
	PJ.10-01b Flight Centric ATC				
PJ.10 Separation Management En-Route and TMA	PJ.10-02A Improved Performance in the Provision of Separation				
	PJ.10-02B Advanced Separation Management				
"Enabling Aviation Infrastructures"					
PJ.16 Controller Working Position / Human	PJ.16-03 Work Station, Service Interface Definition & Virtual				
Machine Interface – CWP/HMI	Centre Concept				
Machine Interface - CVVF/HIMI	PJ.16-04 Workstation, Controller productivity				
	PJ.18-01 Mission Trajectories				
PJ.18 4D Trajectory Management	PJ.18-02 Integration of trajectory management processes in				
1 0.10 45 Trajectory management	planning and execution				
	PJ.18-06 Performance Based Trajectory Prediction				
"High Performing Airport Operations"					
PJ.03a High Performing Airport Operations –	PJ.03a-01 Enhanced Guidance Assistance to Aircraft and				
Integrated Surface Management	Vehicles on the Airport Surface Combined with Routing				
PJ.03b Airport Safety Nets	PJ.03b-01 Enhanced Airport Safety Nets for Controllers				
"Optimised ATM Network Management"					
PJ.07 Optimised Airspace User Operations	PJ.07-03 Mission Trajectory Driven Processes				
Very Large Scale Demonstrations					
PJ.28 Integrated Airport Operations					

ANS CR





Total: 6.1 PM plus travel

- Requierements Engineering
- Data Preparation
- Basic ASR System
- Machine Learning
- Proof of Concept
- Management, Deployment

Main contributions in MALORCA:

- Requirements for Future ABSR
 System (no focus of ML)
- Radar Data and Speech
 Utterance for Prague
- Proof-of-Concept Trials
- Video

Agenda Today / Tuesday



My introduction

Petr Motlicek:

Components of Machine Learning for Assistant Based Speech Recognition

Hartmut Helmke: Proof-of-Concept Trials

Photo Shooting

Coffee break including prototype demonstrations for Vienna Approach (45 min)

60 Minutes for 3 parallel working groups

30 Minutes for presentation of results of workings groups

19:30 "Bettelstudent" Johannesgasse 12

Working Groups Today / Tuesday



WG A:

Which recognition rates are operationally sufficient and affordable for operational needs? How to integrate even more context information? (Chr. Windisch)

WG B:

ABSR in the ops room at Easter 2020 (Dietrich Klakow)

WG C

Active Online-Learning, learning from feedback, using available mouse inputs of the controller or mode-S output or ... (Petr Motlicek)

Agenda Wednesday (Start 9 a.m.)



MALORCA Team (15 min starting at 09:00)
Video, Summary of first day, outlook to second day

Dietrich Klakow (USAAR): Gap Analysis and Next Challenges

Petr Motlicek (Idiap) / Matthias Kleinert (DLR)
Transfer of Assistant Based Speech Recognition to New Approach Areas

Coffee break including prototype demonstrations for Prague Approach (30 min)

Hartmut Helmke (DLR): Cooperation of MALORCA and PJ.16-04

60 Minutes for 3 parallel working groups

30 Minutes for presentation of results of workings groups

12:45 to 13:00: Summary of MALORCA team and selected plenum speaker

Working Groups Tomorrow / Wednesday



WG A

How to exploit MALORCA results (especially with you) PJ.16-04 wave-2, Horizon 2020 ... (Jürgen Rataj)

WG B:

Detailed evaluation of prototypes (Matej Nesvadba)

WG C

Challenges and drawbacks of local phraseology deviations. How to deal with them. (Petr Motlicek)















Covering the sky...

Thank you very much for your attention!



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Founding Members

