



UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

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information technology
electrical engineering



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PhD Student

Nicola Albarella

Control architectures for Advanced Driver-
Assistance Systems in automotive

Tutor: Prof. Stefania Santini

Cycle: XXXV

Year: FIRST

My background

- MSc degree: Automation Engineering
- Research group/laboratory: Daisy Lab (Prof. Stefania Santini)
- Scholarship type: Funded by Kineton s.r.l.
- Cooperation: Kineton r&d



Research field of interest

- Driving assisted vehicles and fully automated vehicles
 - Proven drivers and road users protection enhancement
 - Traffic congestion and pollution reduction



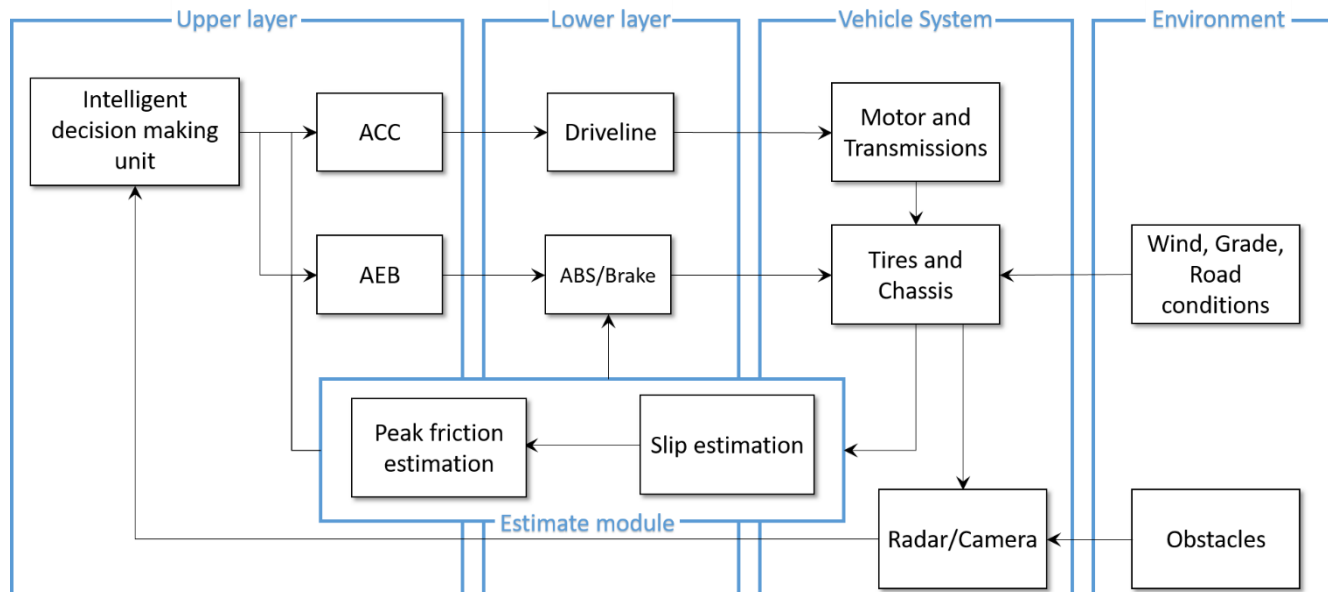
First year activity

- **State of the art:** ADAS (Advanced Driving Assistance Systems) and automated driving functions are designed under the main assumption of flat and dry road surfaces
- The roads are not always perfectly dry
- **Open challenge:** How can we make autonomous driving control strategies robust enough to deal with challenging environmental scenarios (e.g. icy roads)?



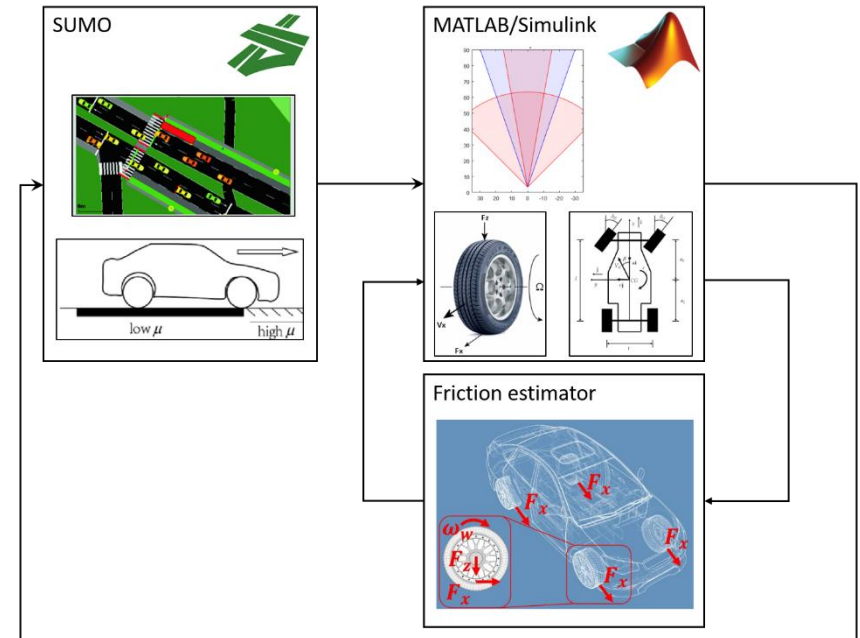
First year activity

- **Contribution:** Design grip-aware control strategy able to adapt the autonomous driving logic on the base of on-board estimation of the road conditions in real time (ACC-Adaptive Cruise Control, AEB-Autonomous Emergency Braking, ABS-Anti-Locking Braking System)
- **Methodology:** Model Predictive Control and non-linear control strategies for vehicle dynamics; numerical validation via a purposely designed highly detailed co-simulation platform.
- **Results:** Increased safety performances assessed via automotive KPIs



Next year activity

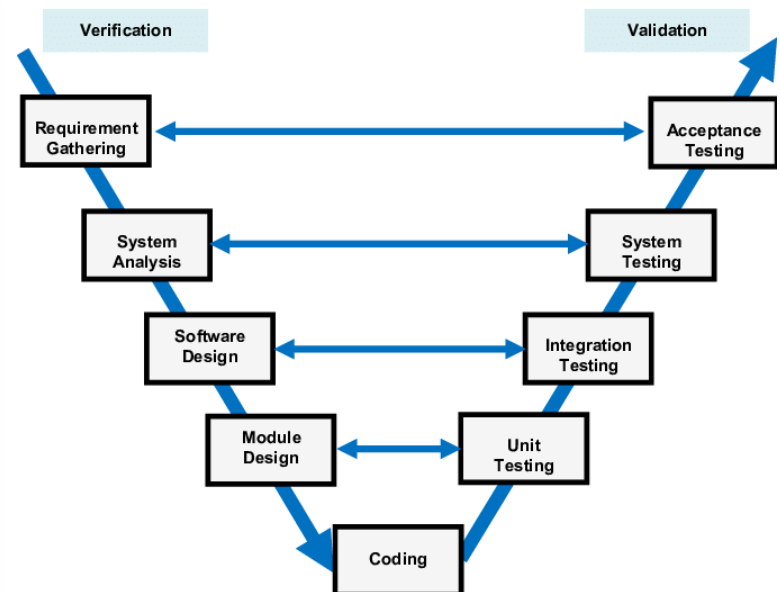
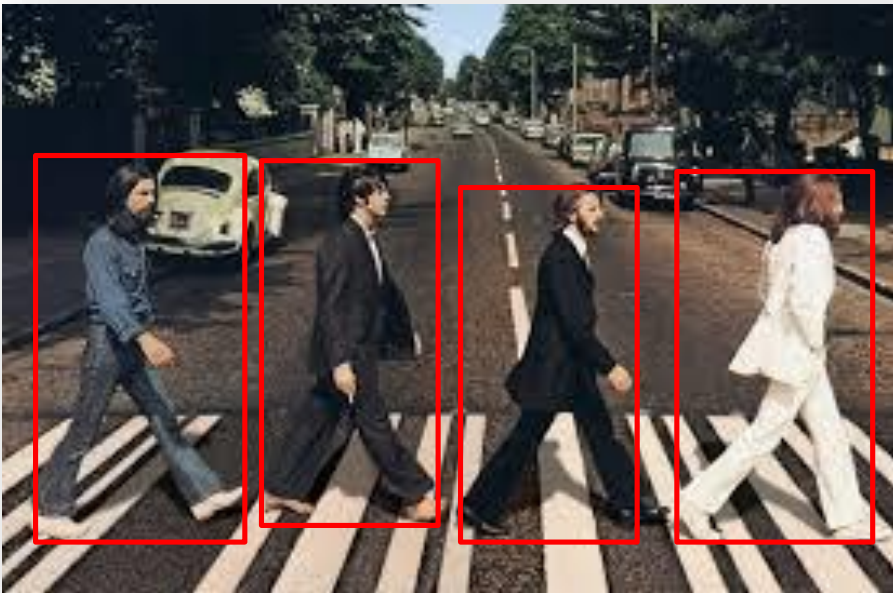
- **State of the art:** ADAS are limited to premium cars
- **Open challenge:** make ADAS safe and affordable for other market shares
- **Objectives:**
 - Replace RADAR/LIDAR with a forward facing camera/s
 - Enhance the co-simulation platform in order to assess the effectiveness or the possible risk originated by ADAS in realistic mixed traffic scenarios



Next year activity

- **Expected contribution:**

- Design innovative collision avoidance control strategies for semi-autonomous and fully autonomous cars, through Model Based Design
- Hardware-in-the-loop and vehicle-in-the-loop validation of the proposed control architectures



Summary of study activities

- Ph.D. School: Scuola Nazionale Dottorandi Ferdinando Gasparini
- Ad hoc Courses: Safety Critical Systems for Railway Traffic Management, Machine learning, Innovation management, entrepreneurship and intellectual property
- M.Sc. Courses: Formal Methods, Embedded Systems, Big Data Analytics
- Seminars: AI and ethics, Large scale training of Deep Neural Networks, Deep learning onramp, Lo spazio cibernetico come dominio bellico, Computational biology, How to get published with the IEEE?, La programmazione europea e la ricerca, SAS Analytics, Planning 5G under EMF constraints, Exploring Autonomy in robotic Flexible Endoscopy
- Others: AVL training

Products

[P1]

[Submitted] N. Albarella, S. Santini, V. M. Arricale, R. Brancati, A. Sakhnevitch, On-board road friction estimation technique for autonomous driving vehicle following manoeuvres, Mechanical Systems and Signal Processing (2020)

Credits earned

	Courses	Seminars	Research	Tutorship	Total
Bimonth 1	1.6	0.8	7.6	0	10
Bimonth 2	3.3	0	6.7	0	10
Bimonth 3	0	0.8	9.2	0	10
Bimonth 4	14	2	0	0	16
Bimonth 5	11.4	0	2.6	0	14
Bimonth 6	6	0	0	0	0
Total	36.3	3.6	26.1	0	66