Documento di sintesi sull'Intelligenza Artificiale per argomento

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1. Courses related to AI

- **Neural Networks and Deep Learning: Theory (3 CFU)**
  Giorgio Buttazzo (RETIS Lab, TeCIP)

  The course teaches theoretical foundations and implementation issues of neural networks and deep learning algorithms. Neural models treated in the course include Hopfield networks, Competitive Learning, Reinforcement Learning, Supervised Learning, Deep Learning and Convolutional Networks.

- **Neural Networks and Deep Learning: Practice (2 CFU)**
  Giorgio Buttazzo, Alessandro Biondi (RETIS Lab, TeCIP)

  The course describes the existing frameworks for deep learning, showing how to structure, implement, and execute deep neural networks on Tensorflow and Caffe. Then, it explains how to implement deep networks on NVIDIA GPUs using the TensorRT framework, showing how to acquire images from a camera and feed them to the neural network to perform different types of processing in real time.

- **Programming in Python (2 CFU)**
  Tommaso Cucinotta (RETIS Lab, TeCIP)

  The course teaches the fundamentals of the Python programming language, data types, control flow statements, built-in functions, and common importable modules, including those for mathematical operations and graphics.

- **Machine Learning (2 CFU)**
  Valentina Colla, Marco Vannucci (ICT-COISP, TeCIP)

  The course provides fundamentals of fuzzy logic, genetic algorithms, and hybrid systems that merge AI-based approaches with standard ones.

- **Digital perception (4CFU)**
  Carlo Alberto Avizzano, Paolo Tripicchio (PERCRO Lab, TeCIP)

  The course teaches the development of intelligent systems to handle data from video/laser sensors. The course targets the use of embedded architectures on dockerized or chrooted, and computer-vision, modelZoo through PyTorch, Darknet and Keras as inference engines. Course topics include: image capture, color handling, perspective geometry and stereovision, feature extraction and classification.

- **Human Motion modeling and Analysis (3CFU)**
  Alessandro Filippeschi (PERCRO Lab, TeCIP)

  The course provides methods for capture and analyzing human motion using methods of biomechanics, computer vision and machine learning. Kinematic and biomechanical models of the human muscolo-skeletal system will be integrated with bayesian filtering, machine learning and computer vision for the study of motion capture and tracking techniques as well as external load estimation.

- **Computer Vision for Humans and Robots (3CFU)**
  P.Tripicchio ex E.Ruffaldi (PERCRO Lab, TeCIP)

  Internal course on Vision and Image Processing for human detection and interaction with robots. The course addresses algorithms for face recognition and feature landmarking, human detection, posture tracking, action detection.

- **Ethical and legal issues in data science**
  Giovanni Comandé DIRPOLIS

  The course illustrates the main legal and ethical issues related to the development and use of AI and big data. It also focuses on the ethical and legal implications of the paradigm shift from causality to probability in the use of data driven applications.

- **Data Protection, Privacy, Ethics and Discrimination**
  Giovanni Comandé DIRPOLIS

  The course addresses ICT multilevel legal landscape; Data protection legal models and practices (further processing, legitimate interests, data subject rights, access rights with particular attention to the EU and the US models); Algorithms' regulation (developer's liability, ethico-legal borders). Discrimination and other legal protection rules (e.g. consumer protection, unfair business practices, competition).

- **Algorithm Accountability**
  Giovanni Comandé DIRPOLIS

  The course deals with algorithm accountability in the context of Machine Learning. Algorithm transparency and the Marketplace/Competition Law. Methods of transparency. Technical and legal options to enhance transparency & accountability. People analytics. Behavioural "nudging". New emerging human rights in the age of behavioral data science and neurotechnologies: Towards "mental privacy" and "decision integrity". Legal and ethical implications of computational capacity.

2. Predictable AI

The objective of this research is to enable the use of AI algorithms and deep networks in safety critical systems, as autonomous cars, advance robots, and space-crafts. These systems must be certified and must react within given timing constraints to exhibit a correct behavior. Unfortunately, current deep learning frameworks are not designed for a safety-critical systems and do not exhibit predictable response times. To solve this problem the following research is carried out:

- **Enabling safety and security in AI algorithms**
  Alessandro Biondi, Giorgio Buttazzo, Federico Nesti (RETIS Lab, TeCIP)

  This work exploits an hypervisor architecture to combine a high-performance computing domain (hosting replicas of neural controllers) with a safe, certifiable computing domain (hosting safety-critical components). The safe domain includes a backup controller, a voter, and a monitoring look-ahead module that switches to the safe controller whenever the results produced by the neural one are judged unreliable.

- **Predictable support for concurrent deep networks on GPU platforms**
  Alessandro Biondi (RETIS Lab, TeCIP)

  This work aims at designing and implementing an inference engine for deep neural networks developed with the TensorRT framework by NVIDIA. This engine allows for time predictable multitasking of a set of deep neural network with different timing requirements to be executed on an embedded GPU (TX2 and Xavier platforms).

- **Deployment of large deep networks on FPGAs**
  Alessandro Biondi (RETIS Lab, TeCIP)

  With respect to GPUs, FPGAs can accelerate computations with a more predictable timing behavior and much less energy consumption. A major problem of FPGAs, however, is that they cannot contain large deep networks. This work exploits dynamic partial reconfiguration and virtualization techniques to create a larger FPGA, where the network can be partitioned into multiple subnetworks that can be executed in time sharing on the physical FPGA fabric.

- **Enhance predictability in Tensor Flow**
  Daniel Casini, Alessandro Biondi, Giorgio Buttazzo (RETIS Lab, TeCIP)

  The native scheduler used in Tensor Flow to run deep neural networks on multicore platforms is optimized for the average case, but can introduce unpredictable delays, making it unsuitable to be used for safety-critical applications. The work aims at enhancing predictability by acting on the node scheduler introducing mechanisms designed to handle network specific workload.

3. AI for robotics

These research activities exploit AI techniques in robotic systems for sensory perception, control, navigation, energy consumption, vision, human-machine interactions, and manipulation.

- **Increasing safety and robustness of neural controllers**
  Federico Nesti, Alessandro Biondi, Giorgio Buttazzo (RETIS Lab, TeCIP)

  This research exploits model-based simulation and digital twin methodologies to increase reliability and safety of neural control systems based on reinforcement learning.

- **Neural modeling of energy consumption in quadrotors with variable mass**
  Mauro Marinoni (RETIS Lab TeCIP)

  This work uses a neural network to estimate the energy consumption of a quadrotor that can carry different objects, so varying its overall mass during the mission. The energy estimation is used to introduce proper safety guards that allow the drone to safely reach a recharging station.

- **ML for perception and autonomous behavior**
  Carlo Alberto Avizzano, Paolo Tripicchio (PERCRO, TeCIP)

  Use of Machine Learning and DNN for object detection, behavior detection, and automated planning. Research is focused on application design, structure of the learning system, transfer training, boarding into low cost and/or robust embedded systems.

- **ML for robust control**
  Paolo Tripicchio (PERCRO, TeCIP)

  The objective is to design and develop robust controllers integrating advanced learning capabilities which combine perception, abstraction and generalization layers in control procedures.

- **ML for smart manipulation systems**
  Paolo Tripicchio (PERCRO Lab, TeCIP)

  The focus is to develop smart manipulation systems and vision-based systems that take optimal decision using experience based training. Skills level include combination of traditional robotics tools with edge AI understanding and decision systems.

- **ML for Programming by demonstration**
  Massimo Satler, Paolo Tripicchio (PERCRO Lab, TeCIP)

  AI algorithms for learning in Kinesthetic and Teleoperation based teaching from demonstration. The research includes AI for human detection and posture recognition, algorithms and models for kinesthetic teaching.

- **ML for Human-Machine Interaction**
  Carlo Alberto Avizzano, Massimo Satler (PERCRO Lab, TeCIP)

  Research on new interaction modalities for teleoperation system applied in industrial context. AI algorithms have been applied to recognize object and get knowledge about the environment as well as to predict the human intent in order to adapt the control system to assist the user performing manipulation and handling tasks. The research contribute to move from the classical bilateral teleoperation control architecture to the shared teleoperation paradigm.

- **ML for intelligent path planning and motion generation**
  Paolo Tripicchio, Massimo Satler (PERCRO Lab, TeCIP)

  This research concerns the study of ML techniques like deep reinforcement learning to generate feasible path planning and movement solutions for industrial robots operations and mobile robots explorations.

- **ML for optimizing the control of wearable robots**
  Simona Crea and Nicola Vitiello (Biorobotics)

- **ML for Robot navigation control during physical human robot interaction**
  Filippo Cavallo (Assistive Robotics Lab, Biorobotics)

- **ML for manipulation tasks**
  Filippo Cavallo (Assistive Robotics Lab, Biorobotics)

- **ML for in artificial touch**
  Calogero Oddo (Biorobotics)

  AI algorithms are applied to calibrate tactile sensors, classify data generated by them, and learn sensorimotor control of tactile interaction.

4. AI for automotive

- **Machine learning for intrusion/malware detection on embedded automotive platforms**
  Alessandro Biondi, Giorgiomaria Cicero (RETIS Lab, TeCIP)

  This project applies machine learning techniques for detecting intrusion and anomalies in a CAN bus and malicious executables in automotive applications.

- **AI For Life Cycle Management of Virtualized Functions in automotive scenario**
  Piero Castoldi, Luca Valcarenghi (TLC, TeCIP)

  We exploit AI to forecast car traffic based on monitored and historical car traffic statistics. AI allows to switch on/off VMs based on monitored traffic (accounting for VM setup time) to save computing, storage and networking resources in order to support collision avoidance algorithms.

- **Intention prediction and behaviour recognition for autonomous driving**
  Massimo Satler, Paolo Tripicchio(PERCRO Lab, TeCIP)

  Research on Intention Recognition for Autonomous Driving to provides autonomous cars with understanding of external vehicle behavior. The research studies on methods for modeling intention prediction using probabilistic graphical models and deep learning using sensor fusion data.

- **Driver intention analysis and manoeuvre anticipation**
  Matteo Unetti, Paolo Tripicchio(PERCRO Lab, TeCIP)

  Research on driver's intention recognition based on driver interaction with the vehicle applying deep neural networks and bayesian filtering on manifolds. Robust Anticipation through Domain-Adversarial Recurrent Neural Networks.

- **AI for Fatigue and watchfulness analysis of drivers (Train transportation)**
  Paolo Tripicchio, Carlo Alberto Avizzano (PERCRO Lab, TeCIP)

  Research on camera-based AI algorithms to estimate fatigue, presence and attention of drivers in several contexts. Boarding into low cost and robust embedded systems

- **Intelligent simulators**
  Paolo Gasparello, Carlo Alberto Avizzano (PERCRO Lab, TeCIP)

  Design and development of embedded intelligence in human driven simulators. Training and learning of vehicle guidance through active skill learning and transfer.

5. AI for cloud computing

- **ML for cloud computing and virtualized network function infrastructures**
  Tommaso Cucinotta (RETIS Lab, TeCIP)

  This task investigates techniques based on artificial intelligence, machine learning and, specifically, neural networks to analyze the massive amount of data coming from the monitoring system of a cloud/VNF infrastructure, for purposes related to supporting operations, performance troubleshooting, root-cause analysis, workload prediction and capacity planning.

- **Fog architecture for distributed deep neural networks**
  Paolo Tripicchio, Carlo Alberto Avizzano (PERCRO Lab, TeCIP)

  The research studies the integration of fog computing and deep learning through novel services to support fast execution and processing of massive data. The main objective of the research is to design a Distributed Deep Neural Network (DDNN) system with the capability to automatically reconfigure itself based on the available resources.

6. AI for industrial manufacturing

- **Data pre-processing and mining**
  Valentina Colla, Marco Vannucci (ICT-COISP center, TeCIP)

  AI-based techniques for raw industrial data treatment to improve the data quality and extract relevant information. Pre-processing mainly concerns outliers detection, removal of redundant variables, reduction of the available variables, and identification of rare patterns. Data mining includes variable selection, features extraction, data clustering and classification, also in case of imbalanced datasets, which is a relevant situation in faults forecasting and diagnosis.

- **Continuous monitoring and predictive maintenance**
  Valentina Colla, Marco Vannucci (ICT-COISP center, TeCIP)

  Use of AI techniques (ANNs, Random Forests, clustering algorithms and fuzzy inference systems) for the early detection and prediction of machine malfunctions in the fields of steel and automotive industries.

- **Soft sensors**
  Valentina Colla, Marco Vannucci (ICT-COISP center, TeCIP)

  ANNs are used to model the behavior of physical sensors in order to substitute them with virtual ones. Motivations are related to the through time reliability of real sensors and their cost. Models are tuned by using real data and are able to self-maintain and improve their performance at different (even uncommon) process conditions. Applications are mostly in the energy, oil, gas and steel sectors.

- **Process modeling**
  Valentina Colla, Marco Vannucci (ICT-COISP center, TeCIP)

  This activity adopts evolutionary computation for parameters identification in complex models and AI-based and hybrid process models for forecasting processes and machine behavior (e.g., Echo-State Neural Network to forecast flow and energy content of process off-gases, ANN for forecasting emissions of turbomachineries).

- **Industrial process control**
  Valentina Colla, Marco Vannucci (ICT-COISP center, TeCIP)

  AI techniques are used to control complex machinery. Exploited technologies include ANNs and fuzzy logic (e.g. Fuzzy-PID) as well as hybrid approaches merging such methods to standard (e.g. Model Predictive Control) ones.

- **ML for for material science**
  Valentina Colla, Marco Vannucci (ICT-COISP center, TeCIP)

  AI and ML techniques are exploited to predict materials properties, product optimization through process tuning, models enhancement and extension. Employed technologies include: ANNs, bio-inspired heuristics (i.e. GAs), fuzzy inference systems and hybrid approaches that merge the cited approaches to standard ones (i.e. physical models).

- **Maintenance on condition**
  Alessandro Filippeschi, Carlo Alberto Avizzano (PERCRO Lab, TeCIP)

  Research and development of perceptual systems and AI computing algorithms for the early detection of wear and damages. Design and development of deep learning algorithm for the object classification, object recognition, defect analysis, wearing classification, object degradation. Integration into embedded automated system using distributed arrays of sensors such as Cameras, Stereo-Cameras, Laser ToF and LiDARs. Application to the transportation context: automotive and rolling stocks.

- **Automatic action segmentation**
  Carlo Alberto Avizzano (PERCRO Lab., TeCIP)

  Research on methodology to segment, recognize and classify an action like the assembly of mechanical components.

- **Automated inspection systems**
  Paolo Tripicchio, Gerardo Camacho, Carlo Alberto Avizzano (PERCRO Lab, TeCIP)

  Research on algorithms (machine learning and DNN) for perception systems composed by heterogeneous sensor to achieve object detection, classification and automated planning for autonomous system (either static system or mobile device) employed in the field for inspection purpose and remote manipulation.

- **Collaborative Robotics in the working cell**
  Paolo Tripicchio, Alessandro Filippeschi (PERCRO Lab., TeCIP)

  This research focuses on the application of Programming by demonstration paradigms with kinesthetic or teleoperated feedback in order to teach a new generation of collaborative robots and machines in Industry 4.0 tasks execution.

- **Quality control in industrial applications**
  Paolo Tripicchio, Alessandro Filippeschi, Gerardo Camacho (PERCRO Lab., TeCIP)

  Development of intelligent systems able to perform quality control assessment in industrial context. Deep learning techniques have been employed and proved successful in real applications including the inspection of welding defects on an assembly line of fuel injectors.

- **Anomaly detection**
  Paolo Tripicchio, Massimo Satler (PERCRO Lab., TeCIP)

  Machine Learning algorithms design, development and integration into embedded system for the identification of anomalies in several domains: (i) Maintenance purpose in the power plants; (ii) Anomaly detection on a coal miller based on Machine Learning applied to large amount of historical data; (iii) Leakage detection based on the data recorded in an array of microphones.

- **Predictive maintenance and process control**
  Massimo Satler, Alessandro Filippeschi (PERCRO Lab, TeCIP)

  Deep learning algorithms and Bayesian Methods for predictive maintenance, model constrained learning system and model predictive process control in the Industy 4.0 context.

- **Complex Assembly solutions**
  Paolo Tripicchio, Alessandro Filippeschi (PERCRO Lab., TeCIP)

  The aim of this research is to develop and validate multifunctional assembly cells, based on neural network software, able to interface mixed/augmented reality devices and co-robot technologies.

7. AI for human movement recognition

- **People behavior modeling and biomechanical analysis**
  Alessandro Filippeschi, Lorenzo Landolfi, Giulia Bassani (PERCRO Lab, TeCIP)

  People's behavior and skills have been modeled from body motion to extract patterns. Deep-learning based on computer vision was adopted for people and vehicles flows evaluation aimed at the collision risk analysis. CNN and object recognition have been applied to biomechanical analysis for the ergonomic assessment of port-related work activities using wearable sensors.

- **Human pose tracking**
  Lorenzo Landolfi, Paolo Tripicchio, Alessandro Filippeschi (PERCRO Lab, TeCIP)

  Research on deep learning algorithms for human body tracking based on camera sensors. The research includes multi-camera extension of common DL open-pose frameworks

- **Automatic activity recognition**
  Lorenzo Landolfi, Alessandro Filippeschi (PERCRO Lab, TeCIP)

  Research and Development of learning analytics algorithms and applications for activity recognition. Research is based on a computer vision theater in-door or outdoor. AI and deep learning algorithm are focused at present in the detection of manual-learning procedure, changes in motion profile, and unusual motion detection.

- **AI for ENACTIVE learning and transfer of human motion**
  Massimo Bergamasco, Giulia Bassani, and Carlo Alberto Avizzano (PERCRO Lab, TeCIP)

  The objective of this research is to study AI algorithms to learn digital representation of skills generalize it and transfers it to novice in the optimal way in order to increase the skill transfer process. This research addressed the following topics: generalization analytics, cognitive transfer for teaching through digitalization, cognitive models through different network structures.

- **Skill transfer in sports and Entertainment**
  Alessandro Filippeschi, Paolo Tripicchio (PERCRO Lab, TeCIP)

  Research on skills transfer in rowing adopts methods of machine learning (initially based mainly on ANN then on DNN), classification and clustering techniques, which have been applied to motion and audio data to segment, classify and evaluate the trainees' performance in the SPRINT rowing training platform. Use of NN to model user gestures and dynamics, application to entertainment in Boxe, Juggling, Thai Chi.

- **ML for human movement recognition**
  Andrea Mannini, Angelo Sabatini, Christian Cipriani (Biorobotics)

  Support vector machines are used for human movement recognition using wrist-worn sensors, activity classifier personalization methods, automatic recognition of the placement site of body-worn sensors and movement segmentation methods based on hidden Markov models. Results have been obtained on both healthy and pathologically-altered gait and this laid the foundation for proposed methods for automatic gait alteration recognition from wearable sensors.

- **ML for decoding the human intended movement**
  Simona Crea and Nicola Vitiello (Biorobotics)

8. AI for healthcare and medicine

- **ML for diagnosis support in systems based on multi-modal sensor platforms**
  Gastone Ciuti and Tommaso Banfi (Biorobotics)

- **ML for surgical risk mitigation in sleep-deprived and fatigued conditions**
  Gastone Ciuti and Tommaso Banfi (Biorobotics)

- **ML for detecting neurodegenerative diseases**
  Filippo Cavallo (Assistive Robotics Lab, Biorobotics)

  ML applied to the analysis of inertial data in neurodegenerative diseases (Parkinson and Mild cognitive impairments and in general for human gesture recognition).

- **ML for detecting emotions**
  Filippo Cavallo (Assistive Robotics Lab, Biorobotics)

  ML applied to the analysis of physiological signals for emotion and stress detection in human robot interaction.

- **Workload estimation and ergonomics analysis**
  Alessandro Filippeschi and Giulia Bassani (PERCRO Lab, TeCIP)

  Research on Human Activity modeling and workload estimation based on multimodal sensors. Development of wearable intelligent sensor for motion and force analysis, as well as smart environment ones based on RGB/IR camera arrays as well as lasers. Development of trained algorithms for statistical and deep learning inference of fatigue, stress, biomechanical risks and work induced diseases. Integration of learning algorithm into automated and interactive robotic environments.

- **Human-machine Interface**
  Antonio Frisoli, Massimiliano Solazzi (PERCRO Lab, TeCIP)

  Research on Human-machine interfaces to control exoskeleton in rehabilitation protocol as well as in teleoperation and virtual reality interaction. development of AI algorithms for biosignal processing and robot coordination.

9. Brain-inspired research

- **Information processing in the nervous system**
  Alberto Mazzoni, Calogero Oddo (Computational Neuroengineering Lab, Biorobotica)

  Simulation of spiking neuronal networks to capture information processing in the nervous system for biomedical and neuro-robotics applications. Recent and ongoing studies: sleep/wake cycle in thalamus, functional consequences of epilepsy and tumor in visual cortex, tactile feedback systems in upper limb neuroprostheses, deep brain stimulation and basal ganglia dynamics in movement disorders, decoding of movements from EMG signals in amputees.

- **Brain-based control architectures**
  Egidio Falotico (Biorobotica)

  Development of control architectures for sensori-motor coordination. The developed models range from classic machine learning methods to spiking neural networks that replicate the activity of specific brain areas.

- **ML for Human-machine interfaces**
  Silvestro Micera (Biorobotica)

  Human-machine interfaces to control prostheses, orthoses, and non human-like robots, such as flying drones. Processing of cortical, peripheral, muscular, kinematic signals. Data-driven design of human-machine interfaces.

- **Biological modeling for object learning**
  Egidio Falotico (Biorobotica)

  This research investigates biologically realistic models (as Hierarchical Temporal Memory and Spiking Neural Networks) for cross-modal object learning in humanoid robots. These models are trained with multisensory information such as color, depth, tactile, and audio.

- **Integrated Photonic Neural Networks for neuromorphic computing**
  Piero Castoldi, Nicola Andriolli (TLC, TeCIP)

  Despite the success of graphical processing units (GPU) and dedicated electrical interconnection architectures, current research and innovation efforts in the field of neural networks are clashing with the limitations of electronic processors in terms of execution speed and power consumption. Optical neural networks can be much faster and more energy efficient than electronic solutions.

- **Biosignal for robot interaction and control**
  Daniele Leonardis, Francesco Porcini, Michele Barsotti (PERCRO Lab, TeCIP)

  Use of BCI, EEG, ET, EMG data and information retrieval for cognitive and mechanical interaction in real and virtual environments. Applied research into biomedical applications and force recovery/extension systems.

- **Multisensory memory**
  Carlo Alberto Avizzano (PERCRO Lab, TeCIP)

  The research is oriented in design and develop cross modality information transfer through capture/model/represent paradigms that make implicit learning from interaction experience. Specific application in the use of robot and tactile interfaces to work with haptics, audio and visual memory.

10. AI and social sciences

- **Philosophy and ethics of technology**
  Barbara Henry (Dirpolis)

  Philosophy of Technology, Jewish studies on Artificial Humanoids, Roboethics in films, Posthuman Political Studies, Imaginary Studies on AI and Robotics.

- **IA e responsabilità penale**
  Gaetana Morgante; Gaia Fiorinelli (Dirpolis)

  Studio dei risvolti sanzionatori connessi all'uso di nuove tecnologie. Ricerca di paradigmi di imputazione della responsabilità penale mirati a garantire la sicurezza e l'affidabilità delle tecnologie. Previsione/prevenzione di rischio-reato. Nuove forme di criminalità connesse alla diffusione delle tecnologie autonome.

- **Ethical and legal aspects of AI**
  Giovanni Comandé, M. Gagliardi, C. Sganga, D. Amram (Dirpolis)

  We study the ethical and legal frameworks in the context in which AI operates and propose regulatory solutions aimed at fostering and sustaining innovation while promoting equality, diversity and fundamental right protection, opening black-boxes, and de-biasing AI & algorithms. Research is focused on i) liability, contract, discrimination, risk management, and insurance issues in the implementation of AI tools, software, and other applications; ii) out-of-the box IP protection and management solutions; iii) ethics & data protection by default and by design compliance.

11. AI and economics

- **Algorithms for causal inference**
  Alessio Moneta (Economia)

  This research explores algorithms that infer causal structures from observed data, exploiting synergies between artificial intelligence and econometrics. Probabilistic graphs models and additive noise models are used to find out the number of latent sources affecting the system.

- **Selection and Aggregation by Evolutionary Financial Markets**
  Giulio Bottazzi and Daniele Giachini (Economics)

  This research line explores the properties of financial markets in terms of strategy selection, information flows and the informative content of prevailing prices. We are also working on extending the numerical and analytical techniques we learned from our previous research to the broad problem of selection and aggregation of predicting models coming from statistics, econometrics, and machine learning.

- **Technical change, industrial dynamics and employment**
  Andrea Mina and Arianna Martinelli (Economics)

  The group is investigating the scientifical and technological foundation of AI and its characteristics relative to comparable technologies. The research focusses on the dynamics of knowledge development and how they translate via adoption and diffusion into industrial and organizational change. It also addresses the complex relations between technology, skills and employment from a micro and macro economic perspective.