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Use Cases and Applications

Detailed description of some of the use cases and applications proposed by the Italian National Body (DOC N 245).

- **Use visual recognition to identify and help fight parasites attacking organic arms in Agriculture**

ID				
Use case name	bioBotGuard			
Application domain	Agriculture			
Deployment mode	Cloud Services or On-prem systems			
Status	PoC			
Contributor	Name	Affiliation	Contact	
	Pietro Leo	IBM Italy	pietro_leo@it.ibm.com	
Scope	Use visual recognition to identify and help fight parasites attacking organic farms.			
Objective(s)	The use case shows how AI contributing to modernize Agriculture industry.			
Narrative	Short description (not more than 150 words)	BioBotGuard defines itself as an initiative of Precision Farming as a Service. From an IT perspective it uses drones with GPS and high-resolution cameras to monitor the crops; the images are then processed by computer vision API in order to spot diseases and harmful insect attacks, building a georeferenced risk map of the crop. This can be used to send operational drones to put the treatment (or antagonist insects) only when and where it is needed.		
	Complete description	BioBotGuard main goals are to cut the use of Phyto-sanitary treatments to contain the environmental health risk by estimating the probability of incubation and development of plant diseases or harmful insects attacks and anticipate treatments. BioBotGuard monitors microclimatic conditions with high accuracy measurement and prediction models to optimize irrigations. From the technology point of view, it employs: AgroDrones to patrol and map the culture filed that are equipped with 20Mx high-resolutions cameras to capture in real-time images. On the backend the drone send data to computer vision API for image classifications and pattern detections. Among others, the system is able to detect harmful insects and build a georeferenced risk map of the crop. As a result, bioBotGuard can help AgriFood producers to change the cost structure of the industry, by requiring less water and less treatment, as well as a significant reduction in labor costs.		
-	ID	Name	Description	Reference to mentioned use case objectives
	1	Optimize Phyto-sanitary treatments	The objective is to contain the environmental health risk by estimating the probability of incubation and development of plant diseases or harmful insects attacks and anticipate treatments.	Improve healthy
	2	Reduced field mapping time	The objective is to reduce the time as well as achieve a more frequent monitoring time of the crop and the field microclimate.	Reduce Time
	3	Reduced Labor Costs	Reduction of the labor costs due to autonomous	Reduce Costs

			monitoring systems	
AI features	Task(s)	Image Classification and Analysis		
	Method(s)	Deep Learning, Pattern Recognition		
	Hardware	Drones		
	Terms and concepts used	Drones, Agriculture, Image Recognition, Computer Vision		
Challenges and issues	Acquire filed as well as crop images at different distances and normalize image recognition and pattern detection			
Societal concerns	None.			

bioBotGuard project Web site and presentation https://www.blueit.it/biobotguard/ https://vimeo.com/238174241

- **Cognitive Procurement: Application of cognitive computing technologies to procurement.**

ID				
Use case name	RAVE			
Application domain	Learning			
Deployment mode	Hybrid Cloud or other			
Status	PoC			
Contributor	Name	Affiliation	Contact	
	Pietro Leo	IBM Italy	pietro_leo@it.ibm.com	
Scope	Use of advanced an multimodal sensing ability to facilitate a complex task			
Objective(s)	Avatar and social robot interact with deaf babies for facilitating language learning.			
Narrative	Short description (not more than 150 words)	RAVE system is an integrated multi-agent system involving a robot and virtual human designed to augment language exposure for 6-12 month old infants. The system is an engineered robot and avatar to provide visual language to effect socially contingent human conversational exchange. The team demonstrated the successful engagement of our technology through case studies of deaf and hearing infants		
	Complete description	The RAVE system is designed as a dual-agent that uses a physical robot and a virtual human to engage 6-12month old deaf infants in linguistic interactions. The system was bolstered by a perception system capable of estimating infant attention and engagement through thermal imaging and eye tracking. RAVE has been designed and experienced for a unique population (deaf infants) during a three period of observation and developing three case studies. This system has been successful at soliciting infant attention, directing attention to the linguistic content, and keeping the infant engaged for developmentally appropriate lengths of time. It has been also observed instances of infants copying robot behavior, of infants producing signs displayed by the avatar, and of infants producing signs to the non-signing robot agent that they had observed the virtual human perform. These initial experiences give the hope that longer-term exposure to a system based on this work may be able to impact long-term learning in this unique population.		
-	ID	Name	Description	Reference to mentioned use case objectives
	1	Soliciting infant attention	The objective is to have a system able to capture the infant attention status and decode his “ready to learn” moment to provide content	Improve learner attention
	2	Keeping Infant	The objective is to	Improve learner

		engaged	keep the learning engaged during the learning process	engagement
AI features	Task(s)	Virtual Humans and 3D model reconstruction, Robot, Biometric status by using thermal cameras, eye tracking, Motion Capture		
	Method(s)	Deep Learning, Pattern Recognition		
	Hardware	Robot, Thermal Camera, Screen		
	Terms and concepts used	Learning, thermal camera, eye tracking, Image Recognition, Computer Vision		
Challenges and issues	Ability to decode a learner cognitive status and his attention level			
Societal concerns	None			

Brian Scassellati, Jake Brawer, Katherine Tsui, Setareh Nasihati Gilani,Melissa Malzkuhn, Barbara Manini, Adam Stone, Geo Kartheiser,Arcangelo Merla, Ari Shapiro, David Traum, Laura-Ann Petitto3. Teaching Language to Deaf Infants witha Robot and a Virtual Human (**http://petitto.net/wp-content/uploads/2014/04/Petitto_CHI18.pdf)**

Nex2U - RAVE Application with Thermal Camera: http://www.next2u-solutions.com/featured-projects/

- **Automatic Logo and Trademark Detection by means of advanced computer vision in Retail/Fashion**

ID			
Use case name	Logo and Trademark Detection		
Application domain	Digital Marketing, Retail and Other (e.g. Fashion)		
Deployment mode	Cloud services or on-premises systems		
Status	PoC		
Contributor	Name	Affiliation	Contact
	Fabio Bresciani	IBM Italia	fabio_bresciani@it.ibm.com
Scope	Identification of logos / trademarks in pictures, optionally performing sentiment analysis associated to the product		
Objective(s)	Understand usage of retail or fashion products and optionally sentiment associated to it, according to pictures posted on the internet or social networks by customers		
Narrative	Short description (not more than 150 words)	The case is about being able to identify logos and trademarks in pictures provided to the AI systems, and optionally derive a positive or negative sentiment for the product based on the written context that was provided with the picture.	
	Complete description	In order to provide business and marketing with a better understanding of how/in what context products are used, AI can be leveraged to help determine customer segments, anticipate changes in brand perception and customer preferences and help generate ideas for designers. The use case involves several steps: ▪ Confirm scope (including countries, targets, logos/trademarks) and business metrics ▪ Select and gather a suitable data set for training and testing the visual recognition algorithm. ▪ Optionally determine the rules that identify a proper context to be analysed with NLP techniques, to understand the sentiment associated to the logo/trademark contained in the picture when posted online.Pictures can be crawled from social networks, forums, and other websites, from which textual context (comments, etc) is obtained as well. ▪ Deploy to production and manage the lifecycle of AI, while providing business with the outcomes of the AI analysis.	

Key performance indicators (KPIs)	ID	Name	Description	Reference to mentioned use case objectives
	1	Number of logos/trademarks identified correctly	This is a technical precision/recall/accuracy measurement of how the visual recognition classifier is performing	Refers to the main objective
	2	Sentiment of Logo / trademark	This is a business measurement, that allows to understand the sentiment associated to a certain logo/trademark. The KPI is usually segmented by picture source, or other variables from the context	Refers to the main objective
AI features	Task(s)	Object detection and localization in pictures, Classification, Sentiment and Tone Analysis		
	Method(s)	Convolutional Neural Networks, Natural Language Processing		
	Hardware	None		
	Terms and concepts used	Visual Recognition, Sentiment Analysis, Tone Analysis		
Challenges and issues	The primary challenge is to be able to correctly identify trademarks in all situations (with bad lighting, image distortions, dirt, etc.) and interpret the sentiment and tone in different countries and languages, as people might use slang and irony.			
Societal concerns	Automated analysis of public posts on social networks might be seen unethical in certain cultures.			

- **Cognitive Customer Care: Application of cognitive computing technologies to customer care in Banking**

ID			
Use case name	Virtual Bank Assistant		
Application domain	Banking		
Deployment mode	Cloud services		
Status	In operation		
Contributor	Name	Affiliation	Contact
	Pietro Leo	IBM Italy	pietro_leo@it.ibm.com
Scope	Use of advanced chatbots and dialogue systems to automatize part of the call center activities		
Objective(s)	Provide better quality help desk support to employees		
Narrative	Short description (not more than 150 words)	The Virtual Assistant of the Bank is the first point of contact for branch operators, who receive immediate answers at any time - it allows to optimize the time of the "human operators" of the Service Desk, which they are dedicated to activities of greater value	
	Complete description	A bank in Italy has created a virtual consultant to support internal staff in their operations and interaction with customers. The solution enabled a significant change in the service model of the bank, allowing to achieve important results in terms of greater contact volumes, extension of service hours and reduction of low-value human-centric activities.	

		The Virtual Assistant has been conceived as the first (and only) access point for assistance, it is easy to use and responds with a high level of reliability to the questions of branch colleagues. The virtual assistant has been not designed as a simple "chatbot" trained on a specific topic, but the virtual "colleague" to turn to for any question, completely integrated into the bank knowledge chain. To date, Virtual Bank Assistant manages all fourteen knowledge domains of the bank receiving thousands of answers. From the beginning of its use (January 2018), the Virtual Assistant manages 100% of the requests, partly independently and partly in collaboration with the human operators of Service Desk. The effectiveness of the solution is evidenced by the very high level of satisfaction, with positive feedback from users exceeding 90% and the reduction in the time spent by Service Desk operators in providing support to the branches, which today can be quantified in a reduction of 25 %.		
-	ID	Name	Description	Reference to mentioned use case objectives
	1	Greater contact volumes with the bank	The objective is to expand the quantity of internal support activities provided by the bank its employees.	Improve productivity of service desk operators (already measured an improvement of 25%)
	2	Extension of service hours	Expand the internal support activities 24/7	Always on
	3	Reduction of low-value human-centric activities	Reduction of the low level labor activities and let employees concentrate on more added value activities.	Improve the quality of work
AI features	Task(s)	Natural Language Dialogue systems		
	Method(s)	NLP		
	Hardware	Web based solution		
	Terms and concepts used	Natural Language Processing, Chat Bot, Dialogues Systems		
Challenges and issues	Provide a natural and consistent interaction with users from different levels of experience (and thus terminology) and background			
Societal concerns	None			

- **Predictive Maintenance for IT systems and applications in Media and Telcos**

ID			
Use case name	Video on Demand Publishing Intelligence Platform		
Application domain	TMT Industry, Technology Department		
Deployment mode	On premise		
Status	Delivered Project		
Contributor	Name	Affiliation	Contact
	PwC		
Scope	Video on Demand Content Preparation Process Error detection & recommendation system		
Objective(s)	System errors comprehension, errors prediction, recommendation engine implementation. Proactive approach to system maintenance problems management.		

<table>
<tr><td rowspan="2">Narrative</td><td>Short description (not more than 150 words)</td><td colspan="3">E2D solution design and development for error detection system based on Machine Learning models and a recommendation engine supported by a reinforcement learning framework.</td></tr>
<tr><td>Complete description</td><td colspan="3">The Errors' detection allows to simulate a workflow and to analyze the process in relation with the current state of the systems, in order to estimate the task error probability and specifying the error type basing on the evidences detected on the systems in the last 20 minutes. The Machine Learning engine exploits the evidences collected in the last 20 minutes on Main Application and on Monitoring system (e.g. each IT system involved in the process).
The most significant variables can directly be the error reason or can be factors indirectly related to an error occurrence. The ML models identify the key metrics values most related to a high error probability level.
Model and user defined actions challenge each other in order to provide the best action prioritization for that specific environmental machines state of art (last 20 minutes history) and the specific simulation test launched.</td></tr>
<tr><td rowspan="4">Key performance indicators (KPIs)</td><td>ID</td><td>Name</td><td>Description</td><td>Reference to mentioned use case objectives</td></tr>
<tr><td></td><td>Error frequency</td><td>Error frequency to be reduced</td><td></td></tr>
<tr><td></td><td>Lateness</td><td>Processing time not aligned with the standards to be reduced</td><td></td></tr>
<tr><td></td><td>Environmental Log errors</td><td>Environmental Log errors</td><td></td></tr>
<tr><td rowspan="4">AI features</td><td>Task(s)</td><td colspan="3">The system produce main errors probability of occurrence, then the next best actions are suggested from an automatic recommendation engine. A reinforcement-learning engine takes final users suggestions if he does not agree with the system suggested action, and at the next simulation, users driven and ML driven actions challenge each other.</td></tr>
<tr><td>Method(s)</td><td colspan="3">Random Forest, Variable Importance evaluation, Sigmoid function for reinforcement learning engine</td></tr>
<tr><td>Hardware</td><td colspan="3">Virtual Machines</td></tr>
<tr><td>Terms and concepts used</td><td colspan="3">Machine Learning, Reinforcement Learning, Recommendation Engine, Environmental logs, Application log, Next Best Action,</td></tr>
<tr><td>Challenges and issues</td><td colspan="4">Machine Learning Engines processing time had to be very short</td></tr>
<tr><td>Societal concerns</td><td colspan="4"></td></tr>
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- **Predictive Testing to support V&V activities in Media Industry**

ID				
Use case name	Predictive Testing			
Application domain	Other (please specify) TMT Industry – Application development			
Deployment mode	On premise			
Status	PoC			
Contributor	Name	Affiliation	Contact	
	PwC			
Scope	Predictive testing of application development			
Objective(s)	Improving the level of automation and the activity throughput of test verifiers by reducing the number of failure notices that are wrongly generated and suggesting mitigation actions according to past experience.			
Narrative	Short description (not more than 150 words)	The solution adopt machine learning to analyze data coming from test results to identify correlation and patterns in order to reduce false positives and suggest recommendation actions		
	Complete description	The testing phase represents a critical point for many companies with a strong technological impact: the execution of the tests is often not very automated, thus requiring a significant effort in terms of people and times, and there is a lack of analysis of the results obtained which generates false positives, or the understanding of where the error occurred and the correct evaluation of the outcome of the general test. The solution consists of adopting Machine Learning methodologies to analyze the available data (coming from different applications and sources involved in the tests), identify correlations and patterns with objectives to identify: false positives, automate testing phases and recommend mitigation actions		
Key performance indicators (KPIs)	ID	Name	Description	Reference to mentioned use case objectives
	1	False positive	Reduce false positives	
	2	Test efficiency	Shorten testing phase	
AI features	Task(s)	Data analysis, Anomaly Detection, Complex event correlations		
	Method(s)	Autoencoders, Restricted Boltzman Machine, Convolutional Neural Network, Long-Short Term Memory		
	Hardware	ND		
	Terms and concepts used	Data integration, compress and denoise, probability distribution of events, complex patterns		
Challenges and issues	Being able to manage and handle different type of data, normalize and use different type of data (including contextual information), integrate the solution in the processes and procedure of the company			
Societal concerns				

- **Application of Predictive Data Quality for small and big data in Financial Services**

ID				
Use case name	Predictive Data Quality			
Application domain	Other (please specify) Data Management			
Deployment mode	On premise / cloud			
Status	PoC			
Contributor	Name	Affiliation	Contact	
	PwC			
Scope	A solution for assessing Data Quality in data collection systems			
Objective(s)	Using machine learning techniques for identifying complex or unknown correlation among data in order to score its quality and enhance the confidence for data consumer in using data for the decision making processes			
Narrative	Short description (not more than 150 words)	The solution adopt machine learning methods to analyze data collected in order to identify complex correlation on data (unknown at priori) and predict data quality issues		
	Complete description	The solution relies on four elements: • Sources: the data sources represent the subject of the assessment. This sources can be heterogeneous (structured and semi-structured) • Model: the representation of the ontology used as a reference for identifying the non-conformity on data • Processes: the set of processes that produce and consume data, whose execution could be affected by the quality of data • Organization and governance: the set of policies, procedures for governing data and handling the advanced data quality techniques		
Key performance indicators (KPIs)	ID	Name	Description	Reference to mentioned use case objectives
	1	Conformity Indicator	An indicator of the intrinsic data quality	
	2	Robustness Indicator	An indicator of the completeness of the set of data quality controls	
AI features	Task(s)	Data analysis, Anomaly Detection, Complex event correlations		
	Method(s)	Bayesian network, Support Vector Machine, CNN		
	Hardware	ND		
	Terms and concepts used	Data integration, data linkage, correlation analysis		
Challenges and issues	Being able to manage and handle different type of data, link data to reference knowledge model, change management in the organization			
Societal concerns				

- **Tourism application of robot equipped with capabilities of functional consciousness offering guided tours in indoor and outdoor museum**

<table>
<tr><td>ID</td><td colspan="5"></td></tr>
<tr><td>Use case name</td><td colspan="5">Robot consciousness</td></tr>
<tr><td>Application domain</td><td colspan="5">Other (please specify) Robotics</td></tr>
<tr><td>Deployment mode</td><td colspan="5">Embedded systems</td></tr>
<tr><td>Status</td><td colspan="5">PoC</td></tr>
<tr><td rowspan="2">Contributor</td><td>Name</td><td colspan="2">Affiliation</td><td colspan="2">Contact</td></tr>
<tr><td>Antonio Chella</td><td colspan="2">University of Palermo, Italy</td><td colspan="2">antonio.chella@unipa.it</td></tr>
<tr><td>Scope</td><td colspan="5">A robot for museum tours equipped with the main capabilities of functional consciousness, accepted and transparent to untrained users.</td></tr>
<tr><td>Objective(s)</td><td colspan="5">The robot “CiceRobot” offering guided tours in indoor and outdoor museum and equipped with capabilities of functional consciousness, with no concern on the robot qualitative experience. The objective of case study is the acceptance and transparency of the autonomous behavior of the robot in an environment populated with untrained users as the museum visitors.</td></tr>
<tr><td rowspan="2">Narrative</td><td>Short description (not more than 150 words)</td><td colspan="4">The “CiceRobot” is a robot with capabilities associated with functional aspects of consciousness. CiceRobot offered indoors guided tours and outdoors guided tours. The outcome of the project is the acceptance and transparency of the autonomous behavior of the robot towards untrained visitors.</td></tr>
<tr><td>Complete description</td><td colspan="4">The “CiceRobot” is a robot with the capabilities associated with the functional aspects of consciousness. The architecture was instantiated on a wheeled robot for indoor use, on a wheeled robot for outdoor use and currently is instantiated on a humanoid robot. The robot has capabilities associated with the functional aspects of consciousness:
• to build and to maintain an internal model of the environment and itself;
• to pay attention to the relevant entities in the environment;
• to integrate information from different sources and different parts of the same source;
• to generate expectations about the possible events in the environment;
• to self-monitor;
• to simulate emotional states;
• to process information by making it globally available to the robot.
The primary outcome of the case study is the acceptancy and transparency of the autonomous behavior of the robot in an environment populated by untrained users as museum tourists.</td></tr>
<tr><td rowspan="2">Key performance indicators (KPIs)</td><td>ID</td><td>Name</td><td>Description</td><td colspan="2">Reference to mentioned use case objectives</td></tr>
<tr><td>1</td><td>Robot transparency</td><td>The capability of the robot to act in a transparent way to tourists.
The transparency of robot behavior is measured by questionnnaires, M.O.S. on scale 1 – 5.
The transparency of personal data handling and mitigation of cyberattack is pursued by local use of data (what happens to the</td><td colspan="2"></td></tr>
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			robot remains on the robot and it is part of its personal history) and measured by questionnnaires, M.O.S. on scale 1 – 5.	
	2	Robot acceptance	The capability of the robot to be accepted by tourists as a museum guide is measured by user satisfaction questionnaires, M.O.S. on scale 1-5.	
AI features	Task(s)	Internal model generation, attention, self-modeling, global workspace, expectation generation, information integration		
	Method(s)	Neural networks, symbolic representation systems, hybrid symbolic-subsymbolic systems, global representations.		
	Hardware	Wheeled indoor robot; wheeled outdoor robot; humanoid robot.		
	Terms and concepts used	Consciousness, attention, information integration, self-monitoring, expectation generation, internal modeling, global workspace.		
Challenges and issues	The primary challenge of robot consciousness is the transparency and acceptance of robot operations, important in environments populated by untrained people as tourists in an archaeological museum.			
Societal concerns	The main concern may be the capability of the robot to act in a way which may is considered unethical to humans.			

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