



2018

SAS Workshop Report – Oct 2018

The poster for the IEEE Technology Time Machine 2018 event. It features a central graphic of a colorful, wavy, multi-colored ribbon (rainbow spectrum) against a dark background. The text on the poster includes the IEEE logo, the event title "IEEE Technology Time Machine 2018", the dates "31 October - 1 November 2018 | San Diego, California, USA", and a list of topics: "Virtual/Augmented Reality - Brain Computer Interfaces - Agricultural Technology Neuroscience - Far Future Technologies - Entrepreneurism & more...". Logos for IEEE N3XT and IEEE Entrepreneurship are also present.

IEEE
TECHNOLOGY
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IEEE Technology Time Machine 2018
31 October - 1 November 2018 | San Diego, California, USA

Virtual/Augmented Reality - Brain Computer Interfaces - Agricultural Technology
Neuroscience - Far Future Technologies - Entrepreneurism & more...

IEEE N3XT

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IEEE
Entrepreneurship

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IEEE Symbiotic Autonomous Systems
10/30/2018

The SAS Workshop in San Diego was run in conjunction with TTM2018, a fitting association since the horizon on the initiative is long term 2040-2050.

As it was pointed out in the opening introduction by Roberto Saracco, the Initiative chair, the implications are being felt today and steps need to be taken today to prepare for a future that we like.

It was pointed out that the evolution towards Symbiotic Autonomous Systems is “almost” inevitable. It will be the end result of the concurrent evolution of machine augmentation and human augmentation converging on a symbioses.

Prosthetics are becoming smart, better able to cope with disabilities and in some cases they can provide improved performances. Artificial intelligence and machine learning create a perfect fit of the prosthetic with that specific person. The market is expected to increase exponentially in the next 5 years and at that point there is expectation to see prosthetics being adopted for human augmentation in specific areas (some examples are already available today, as Ford workers using exoskeletons to relieve fatigue on the assembly line).

Education is another key area. As data, information and knowledge is expanding exponentially it has already reach the thresholds where it is no longer possible to remain up-to-date in several fields. Hence tools are being created to harvest distributed knowledge and create a pool of knowledge. This pool is mediated by machines and more and more machines are component of this pool. IEEE has a tremendous repository of knowledge, the real challenge in the coming years is to keep it usable.

Ethical issues are emerging as automation is progressing. There are quite a few that are important today and there are more that need to be faced today even though they will become relevant in 10 to 20 years time, because decisions that are being taken today will be influencing the evolution and the future ethical landscape.

Derrick pointed out that we are starting to see first impact of technologies that started some 20 years ago and what is happening is a subtle changing of who we are because the way we interact is conditioning who we are. More than that, we have started to have a parallel life in the cyberspace, something whose first attempt can be connected to Second Life, now faded away having been replaced by other “second lives”, be it Facebook, Instagram, Replika. So much of our social life has shifted to the cyberspace. This shift to the cyberspace (or in other terms the growing impact of the cyberspace on our social life) is creating a new “human”, in a way an augmented one.

As on one hand data are reshaping our experiences and our behaviour, hence redefining who we are, on the other hand it brings to the fore the issue of who controls the data. In a way this is not a new problem, media have been a powerful lever in steering public opinion and de facto in controlling it. Data today, however, can be much more effective in steering behaviour and it becomes much faster to influence public as well as, and this is a novelty, single individuals. Interestingly, as well as frightening, there will be new players on the societal stage: robots and bots and these entities are now starting to play a role. Bots roam the cyberspace and are

becoming agent of change to the point that some Countries are starting to legislate, forcing bots to declare they are not humans.

There bots/robots are executing algorithms and there is therefore the issue of algorithm fairness. This is a difficult issue with autonomous systems since they will have more and more the capability of changing the algorithm they are executing, thus making it quite difficult, impossible?, to control their fairness. And, of course, what is fairness? Who is deciding what is fair?

Antonio presented a bricolage of the pervasiveness of autonomous systems in the area of aviation. The drone ecosystems has exploded with thousands of companies and millions of users. If there are now millions of mass market drones there are quite a few of very sophisticated autonomous flying machines. A crucial aspect of their autonomy is their decision making capability. This decision making capability is today pursued in terms of "human-like". Today's design of autonomous flying machines is missing a system wide design. We need to move from design a single machine to design the ecosystem and have the machine to inherit the design principles of the ecosystem. All together they will be showing an emerging behaviour. A major challenge is a direct consequence of an automation that is influenced by the environment. This "influence" opens the door to cybersecurity issues.

John started by asking people to send him their own social security number plus a few other information and seeing no one eager to do that asked: Why don't you trust me? Trust indeed is a crucial aspect and SAS need to gain it in order to be successful on the market. Cybersecurity is a most important component in maintaining the trust. Trust is going to be an emergent property of a SAS and this may prove to be quite difficult to work out given the multiplicity of components. We normally see trust deriving from experience and experience is mostly based on interactions.

Paolo shifted the focus on "making it happen". What are the challenges faced by a public administration in the deployment of autonomous systems.

Although a small area, both in terms of geographical area and population, the Trentino area is facing challenges in meeting the needs of citizens. Public transportation has to meet the needs of both the urban and rural area, providing service in an economically sustainable way.

The public administration has to provide services by creating an ecosystem that stimulate private companies to offer them. These companies need to find cost effective solution, to generate revenue. The public administration has a key role in this by investing in the global infrastructures, like sensors deployment, and opening them up for private companies to use. Open data has been a key component in this endeavour.

The other crucial aspect is to create sufficient demand for services, create the market. This is pursued by the public administration through gamification, a way to engage and steer citizen demand.

Two specific projects focussed on autonomous systems were presented.

- Cooperative, connected and automated mobility: the project aims at creating a sensor infrastructure overlaid on the highway system supporting autonomous trucks for good transportation.

- Autonomous systems for people goods delivery: this connects to the previous one complementing it for the last mile for urban and rural delivery.

Interestingly this sensors infrastructure at the urban and rural level connects to another initiative, the walking bus, a way to make safer the “go to school” of young children, where each child has a tag that connects to the sensors locating the child over his walk to the school along with the other children.

The closing part of Paolo’s presentation focussed on citizens’ Digital Twins, where a first step in this direction is being taken by the Province of Trento in the healthcare area by harvesting health data that are kept in Personal Data Storage under the control of the single person. This approach is just a first step in the direction of a full Digital Twin and has a lot of potential, although it will take a few more years to fully exploit them (both to the advantage of the single, offering personalised cure and to the advantage of the whole community as an example for the early detection of epidemics).

Aman guided the discussion on the implicit duality of technology, the good and the bad side. The Societal, Physical and Digital Universes are on a collision route. This is manifest in autonomous systems where we see Digital Security (including bots vs Bots), the Physical security (Drones vs Drones) and Political security (human vs human). The evolution towards SAS is seen as inevitable, issues have to be faced and challenges met.

The thought provoking presentations generated significant discussions and set the stage for working groups analyses of a few questions, clustered in two sets, the first focussing on Societal aspects, the second on implementation aspects.

1st set – Societal Aspects

Looking at the Cyberspace as an Autonomous System

The Cyberspace can indeed be considered as an Autonomous System given the number of loosely interconnected players populating it with data, information and services.

Out of this AS a variety of communities, fleeting or stable, emerge. The issue of impact of this AS on Society is clearly strong and it keeps growing begging the question of what the future may bring. If we look at the past we can see an evolution in terms of societal impact mediated by minstrels in the middle age (they were the ones bringing information to village and township people), then by the printed press (slowly evolving into newspapers) and in the last century by television. In this last decade the cyberspace with the like of Facebook and Instagram has taken the lion share in bringing information to people.

In the future? The consensus was that augmented reality will be playing a major role continuously connecting the cyberspace to individuals. Big data companies will dominate and it was noted that a “Digital Lord” possibly consisting of a Watson-like intelligence could dispense customised information.

Fake News

The huge amount of data/information on the web is pestered by a huge amount of false and misleading data and sorting the wheat from the chaff is getting more and more difficult. Given the growing impact of the cyberspace on our Society this is clearly a major problem. It was noticed that whilst in some cases a data can be clearly false and a news can be clearly fake, in many situations the truthfulness of a news or a data can be debatable. A data can be true

airplane accident have a human root) and yet the conclusion can be completely wrong (if we have self flying airplane –hence with no human pilot error possibility) flights will be safer (this conclusion does not take into consideration the situations where a pilot saved the flight...). A data can be true, temperatures are rising on average worldwide, but the real reason is debatable as we have seen Earth experiencing in the past cycles of warming and cooling...

Standards are seen as a way, in some cases, to create a clear, acceptable, reference against which to assess data, information and processes. Rating media channels (like peer to peer review) can also be another way to provide trustable information. Both are not silver bullet since it is anyhow impossible to manage the huge, and growing, cyberspace with these tools.

A further approach would be to create a trusted centralised control on information but, of course the issue is to ensure the credibility of that control point, another is to use blockchains to connect a data/information to a source and to the potential people/entity having a stake in that. Overall education is crucial in creating the mental tool to detect fake news.

Digital Twins

The growing importance of Digital Twins and the creation of person's digital twin raises the issue of authentication and security of a digital twin. Just think about the application of digital twin in healthcare and in economic transactions as proxies.

Tools may provide some form of protection but it was noted that protecting a digital twin is trickier than protecting data since a digital twin evolves (read can be influenced) as it interacts with its environment and protecting a digital twin would require assessing the truthfulness of each interaction.

No silver bullet is on the horizon and eventually the physical person will be responsible and accountable for her digital twin.

2nd set – Implementation Aspects

What is the best strategy for public administration in tackling autonomous systems

Clearly having a Public Administration fostering the creation/deployment of autonomous systems would be highly desirable since it would happen in an institutional framework. On the other hand many public administrations do not have sufficient resources to invest in uncertain futures and have to confront with a citizenship that may not be prepared to that evolution.

The creation of a regulatory framework conducive to the creation and deployment of autonomous systems by third (private) parties is also a good way of moving forward, keeping the public investment low and maintaining the steering.

Some PA would rather choose a more cautious approach to wait and see, letting other to take the lead and entering the game once more certainties are available.

Security is a major concern for public administrations and private companies alike. What should be the strategy with respect to autonomous systems?

Public administrations may set up certification procedures that would de facto steer the evolution in certain directions but this is not sufficient. They should also ensure a continuous monitoring of the deployment and its effect with the goal of anticipating issues and problems.

They should also, but that would be the last straw, follow the patch up of any problem that may show up.

How can IEEE take the lead in the autonomous systems area?

Taken for granted that IEEE has its strength and roots in the technical area in the specific domain of symbiotic autonomous systems there is a need for a global approach requiring the involvement of several IEEE Societies as well as that of other constituencies. Hence IEEE should promote this aggregation maintaining the lead in the technical area and sharing responsibility on the overall evolution with other constituencies (economic, societal,...).

This domain will require the addressing of several issues involving a variety of partners with biased interest. IEEE can become a neutral trusted party towards institutions a Society leading in standardization, creating framework and in some areas supporting certification.

Most importantly, it is felt that IEEE should take the lead in the implementation of a few trial, aggregating industry, academia and institutions, as an example in the area of education explore the applicability of Digital Twins, harvesting the huge knowledge base of IEEEExplore and its membership.