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## FUTURE OF INFORMATION IN SWITZERLAND

A stronghold of AI technology since a long time, Switzerland has some ambitions towards digital and information revolution. Its research centers are advanced in multiple information-related domains and numerous companies are already active in digitalisation technologies, especially for medical applications. Despite the lack of “anti-deep-fake” legal plan, Switzerland is well equipped to take a place in the forefront of the future of information.

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**S** Start: no real activities      **T** Trend: Early activities      **A** Advanced      **R** Ready

### 1. Digital twins

Switzerland has a strong position in *Digital twins-related* technologies. EPFL (VITA<sup>1</sup>) and ETHZ are worldwide key players in research, leaders with more than 25 laboratories in Health EU project<sup>2</sup> that is dedicated to combine customized medicine with digital technology, using the latest technological developments such as connected objects, artificial intelligence and the concept of “digital twins”<sup>3</sup>. EPFL’s activity extend beyond medicine toward Industry 4.0 with the Horizon2020 project QU4LITY (Digital Reality in Zero Defect Manufacturing)<sup>4</sup>. This project also involves Swiss industry Agie Charmilles. Several companies are active in this field: Akseles<sup>5,6,7,8</sup> (world leader in digital twin technology), Biovotion’s Everion<sup>9,10</sup> (wearable device which combines advanced machine learning with physiology biomarkers to monitor and analyse patient’s data) and Nomoko<sup>11,12</sup> (digital twin of geographical locations). Some academic works about ethical and policy challenges which come along with the development of digital health in Switzerland have been conducted by ETHZ and the university of Cambridge in 2018<sup>13</sup>.

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### 2. Digital Genetics

In 2015, ETH Zurich stored the text of the Swiss Federal Charter of 192 in DNA as a proof of concept<sup>14</sup>, using a proprietary technology. In 2017, EPFL in association with US company Twist Bioscience, Microsoft and the university of Washington safeguarded two songs in DNA strands as part of the Montreux Jazz Digital Project<sup>15</sup>. In 2018, ETH Zurich’s Functional Materials Laboratory stored an entire music album (15- megabyte) by Massive attack in the form of DNA and poured into tiny glass beads<sup>16</sup> with the help of its Zurich-based spin-off TurboBeads<sup>17</sup>. ETHZ also has very advanced capacities in computer-designed genome<sup>18</sup>.

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### 3. Digital backups of the human mind

Transhumanism is not yet a real topic in Switzerland, neither is digital backup of the human mind. The closest research to this topic taking place in the country is the Blue brain project<sup>19</sup> that intend to build and simulate digital reconstructions of the brain.

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### 4. Human brain simulation

Switzerland is a top spot for human brain simulation. The country hosts the Blue brain project<sup>20</sup> with the goal to build biologically detailed digital reconstructions and simulations of the rodent, and ultimately the human brain. Blue Brain is run by IBM and the EPFL. The project involves more than 80 searchers since 2005 and published more than 160 scientific papers<sup>21</sup>. Based on the research strategy developed in the Blue Brain Project, European Human Brain Project (HBP)<sup>22</sup> was launched in 2010. It is a consortium of 131 European and International partners in which EPFL takes a central place<sup>23</sup>.

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## 5. Cyborg

Swiss research centers are massively involved in this topic. Projects cover brain-machine interface (EPFL<sup>24,25,26</sup>, ETHZ, Bern University<sup>27</sup>), exoskeletons (EPFL<sup>28,29</sup>, ETHZ<sup>30,31</sup>, HSR University<sup>32</sup>) and powered prostheses (EPFL<sup>33</sup>, ETHZ<sup>34</sup>, Bern University<sup>35</sup>, HES-SO<sup>36</sup>). Opened 1st December 2010, the National Centre of Competence in Research (NCCR) Robotics is a Swiss nationwide organisation funded by the Swiss National Science Foundation that binds together experts from EPFL, ETHZ, UZH<sup>37</sup>, IDSIA<sup>38</sup>, UNIBE<sup>39</sup> and Empa<sup>40</sup> with the objective to create exoskeletons and prosthetic limbs that can be controlled by the brain. Multiple Start-ups have already been created: Fes-ability<sup>41</sup>, Intento<sup>42</sup>, MyoSwiss<sup>43</sup>, Noonee<sup>44</sup>, SenArs<sup>45</sup> and TWIICE<sup>46</sup>. The country also hosts organizations such as SwissLimbs<sup>47</sup> and Project circleg<sup>48</sup> that promote actively the use of powered leg prostheses.



## 6. Smart contact lenses

Smart contact lenses developments in Switzerland are mainly related to the medical field. Several Swiss companies are developing smart lenses for medical monitoring (to treat glaucoma): Sensimed<sup>49</sup>, Tissot Medical Research<sup>50,51</sup> and Fabrial<sup>52</sup>. EPFL<sup>53,54</sup> and ETHZ<sup>55</sup> both have smart-lenses-related projects. In 2014, Novartis (Alcon eye-care division) announced its collaboration with Google (Verily) to develop high tech contact lenses able to monitor glucose levels in real time in order to help patients with diabetes. After 5 years of developments, the "duo" decided to pause this project as the first results were not conclusive. They decided to explore new leads like smart contact lenses to improve patient sight after cataract surgery or contact lenses specially designed to treat presbyopia.



## 7. Body storage

ETHZ have created a biosynthetic dual-core cell computer, "the first cell computer with more than one core processor"<sup>56</sup>. ETH researchers have integrated two CRISPR-Cas9-based core processors into human cells, with potential applications in the biological signal detection as well as in the treatment of cancer. The Department of Biosystems Science and Engineering is exploring the application of information-processing diagnostic circuits in cell therapies or tissue engineering to monitor current cell state<sup>57,58</sup>.



## 8. Artificial Intelligence

Switzerland has a long history of research in AI. In 1971 the world's first IA centre was created in Manno, in the suburbs of Lugano, then two other centres followed: the ISSCO at the University of Geneva (semantics) and then in 1991, the IDIAP<sup>59</sup> in Martigny, specialising in perception<sup>60</sup>. This "natives" were joined later by Google (2'500 data scientists in Zürich), Facebook, who acquired Zurich Eye (ETHZ Spinoff) in 2016<sup>61</sup>, IBM<sup>62</sup> and Microsoft<sup>63</sup>. The country is now at the forefront of AI researches with multiple top academics in the field: ETHZ<sup>64</sup>, EPFL<sup>65</sup>, University of St. Gallen<sup>66</sup>, IDIAP<sup>67</sup> and IDSIA<sup>68</sup>. Switzerland is considered "a hub for AI" by a 2019 SGE's report<sup>69</sup>. 2017 Asgard's European AI Landscape stated that Switzerland has the most AI companies per citizen<sup>70</sup>. Key AI-related Swiss companies are: NVISO<sup>71</sup>, Spinningbytes<sup>72</sup> and MindMaze<sup>73</sup>.



## 9. Chatbots

A lot of Swiss companies already use chatbots for their customer service<sup>74,75</sup> (Helvetia<sup>76,77</sup>, SBB<sup>78</sup>, Postfinance<sup>79</sup>, Swiss<sup>80,81</sup>, Swisscom<sup>82</sup>). Several companies propose chatbot design and implementation services, some of them are: Obeeone<sup>83</sup> (developed with HES-SO), Dermintel<sup>84</sup>, Siropbot<sup>85</sup>, Enterprise bot<sup>86</sup>, ELCA<sup>87</sup>, AdNovum<sup>88</sup>, Paixon<sup>89</sup> and Spinningbytes<sup>90</sup>. ETHZ, St Gallen University and the Swiss research institute for public health and addiction developed an open source behavioral intervention platform (chatbot) for fully-automated digital interventions named MobileCoach<sup>91</sup>. In politics, the Swiss government uses this technology<sup>92</sup> but political parties are still very modest when it comes to social medias and technology<sup>93</sup>.



**10. Fake news prevention**

In June 2018<sup>94</sup>, the Swiss government recognized the fake-news as a possible threat to the national political system, based on direct democracy, an opinion shared by 75% of the population<sup>95</sup>. Despite this possible threat, no “anti-deep-fake” legal plan is considered in Switzerland. Harder legislation, as France consider adopting, is regarded as a risk to transfer the political debate to courts and reduce freedom of speech and freedom of the press. The existing legislation is considered as strong enough. Quantum Integrity, an EPFL Start-up, is developing a software that will detect deepfake video. It may be operational in 2020<sup>96</sup>. Another similar project exists at Idiap<sup>97</sup>. Prof. Monti, of the University of Lugano, co-founded Fabula in 2018, a Twitter-owned London-based fake-news detection Deep Learning company<sup>98</sup>



**11. Digitalisation & Privacy**

The Swiss federal government recognized<sup>99</sup> that “digital content is one of the most important drivers of growth for the digital economy [...]”. However, it is also necessary to address the risks of increasingly data-based decision-making, including the lack of transparency of computer-based conclusions and possible unequal treatment of people.” To answer these challenges, the Federal Office of Communications (OFCOM) established the “Switzerland Digital Strategy<sup>100,101</sup>”, a set of principles and actions that “guarantee security, trust and transparency” when it comes to data collection, storage and use. Its objectives are legal<sup>102</sup>, economic<sup>103</sup>, technologic<sup>104</sup> and the protection of privacy<sup>105</sup>. More than 150 leading companies, organisations, academia and politics joined forces in the digitalswitzerland<sup>106</sup>, a multi-stakeholder initiative created to strengthen Switzerland’s position as a leading innovation hub.



**Conclusions**

<p><b>Switzerland’s strengths</b></p> <ul style="list-style-type: none"> <li>• Academia developing a lot of advanced projects</li> <li>• Switzerland Digital Strategy</li> <li>• Switzerland is considered “a hub for AI”</li> <li>• A well developed medical-related “cyborg” activity</li> </ul>	<p><b>Switzerland’s weaknesses</b></p> <ul style="list-style-type: none"> <li>• Vulnerable to fake-news and AI-driven disinformation</li> </ul>
<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• Blue Brain project and Digital Twins project give the country a head start in these fields</li> <li>• World premiere in digital genetics open potential leader position in this technology</li> </ul>	<p><b>Threads</b></p> <ul style="list-style-type: none"> <li>• No digital backup of human brain project</li> </ul>

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<sup>2</sup> <https://www.health-eu.eu/>

<sup>3</sup> <https://actu.epfl.ch/news/with-health-eu-everyone-will-have-an-avatar-to-man/>

<sup>4</sup> <https://cordis.europa.eu/project/rcn/220162/factsheet/en>

<sup>5</sup> <https://akselos.com/blog/akselos-rb-fea-is-the-digital-twin-gold-standard-by-dr-knezevic/>

<sup>6</sup> <https://akselos.com/news/akselos-to-create-worlds-first-digital-twin-of-hydroelectric-power-station/>

<sup>7</sup> <https://www.zdnet.com/article/this-power-station-the-size-of-a-cathedral-is-getting-a-digital-twin/>

<sup>8</sup> <https://www.ictjournal.ch/articles/2019-07-10/digital-twins-des-clones-virtuels-au-service-du-reel>

<sup>9</sup> <https://www.biovotion.com/everion/>

<sup>10</sup> <https://www.startupticker.ch/en/news/august-2018/pain-management-solution-with-Swiss-wearable-technology>

<sup>11</sup> <http://nomoko.world/>

<sup>12</sup> <https://www.switzerland-innovation.com/node/326>

<sup>13</sup> <https://smw.ch/article/doi/smw.2018.14571>

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