



Artificial Intelligence (AI) has always been the subject of dreams and visions about the distant future of humankind. Even though we are nowhere near a conscious robotic system, nowadays, AI systems are ubiquitous and showing tremendous successes in various fields of our everyday life. We are using these on a daily basis, often without even noticing. Whether it is the Virtual Personal Assistants on our mobile phones (such as Siri<sup>1</sup>, Google Now<sup>2</sup>, and Cortana<sup>3</sup>), self-driving cars, the ranking of the web pages given your search query, or the classical textbook examples such as spam filtering and recommendation systems of online media providers and marketplaces like Amazon.

Various fields of AI have made a major leap forward in the recent years. As most AI systems are too complex to be defined manually, we have to resort to automatically learning rules and patterns from data using sophisticated machine learning (ML) techniques. A prominent example is Google Deepmind's AlphaGo<sup>4</sup> that, using lots and lots of training instances, learned to play the game of go, eventually beating the world's best go player. Another important field of AI is Natural Language Processing (NLP) which is a requirement for personal assistants, chat-bots or an AI system playing the game of Jeopardy such as IBM Watson<sup>5</sup>.

These successes are facilitated by the massive amounts of data that we have today. Whether it is unstructured data, such as text documents, images, and videos, or structured data that is pre-defined and is machine readable. Especially in the insurance industry, data is available in abundance which – like in many other sectors – lead to another recent development of big data architectures and techniques that include various steps such as data collection, data cleansing, data consolidation, data storage, and analytics, among others, to make sense of the data. Patterns in the data, however, escape the attention of the human eye, due to the fact that they are not obvious or the amount of data is just too large to be processed by an expert in the domain. Analytics and Business Intelligence (BI) applications use historical and current data about the business at hand and help to make the right decisions in an informed manner by focusing on what happened, understanding performance, and monitoring Key Performance Indicators (KPIs). AI techniques, on the other hand, are forward looking. Given the historical and current data, what can we uncover in

the data? What can we predict for future developments? What can we optimize? What can be automated? In that sense,

*Artificial Intelligence is the logical next step after Big Data.*

Insurance carriers can thus greatly benefit from the recent advances in artificial intelligence and machine learning. A lot of approaches have proven to be successful in solving problems of great interest such as pricing, claim handling, and fraud detection among others. In the following, we will introduce some areas where AI can aid in tackling these challenges and give a brief, non-exhaustive overview of the companies and InsurTech start-ups in these fields. Note that, the assignment of these tools to the different categories can not be done without overlap, since some tools and start-ups may tackle various problems. We tried to partition based on the main area of focus.

**Claims Management and Fraud Detection** Claims management can be augmented using machine learning techniques in different stages of the claim handling process. By leveraging AI and handling massive amounts of data in a short time, insurers can automate much of the handling process, and for example fast-track certain claims, to reduce the overall processing time and in turn the handling costs while enhancing customer experience. The algorithms can also reliably identify patterns in the data and thus help to recognize fraudulent claims in the process. With their self-learning abilities, AI systems can then adapt to new unseen cases and further improve the detection over time. Furthermore, machine learning models can automatically assess the severity of damages and predict the repair costs from historical data, sensors, and images. Two companies tackling the management of claims are *Shift Technology*<sup>6</sup> who offer a solution for claims management and fraud detection and *RightIndem*<sup>7</sup> with the vision to eliminate friction on claims. *Motionscloud*<sup>8</sup> offer a mobile solution for the claims handling process, including evidence collection and storage in various data formats, customer interaction and automatic cost estimation. *ControlExpert*<sup>9</sup> handle claims for the auto insurance, with AI replacing specialized experts in the long-run. *Cognotekt*<sup>10</sup> optimize business processes using artificial intelligence. Therefore the current business processes are analyzed to find the automation potentials. Applications include claims management, where processes are automated to speed up the circle time and for detecting patterns that would be otherwise invisible to the human eye, underwriting, and fraud detection, among others. AI techniques are potential game changers in the area of fraud. Fraudulent cases may be detected easier, sooner, more reliable and even in cases invisible to the human eye. Above, we have seen a number of companies that make use of AI techniques to detect fraud during the claims processes, such as *Shift Technology*, *Motionscloud*, and *Cognotekt*. Others include SAS<sup>11</sup> with their fraud framework for the insurance industry that detects fraud in the claims and underwriting processes and IBM's Counter Fraud Management for Insurance solution<sup>12</sup>.

**Underwriting and Loss Prevention** Automatic underwriting can tremendously speed up the process and often render expensive tests unnecessary by combining several relevant data sources, even external ones that are not present in the medical records. If you can infer a healthy lifestyle from marketing or social profiles, that may well translate to other parts of a person's life. Insurances usually come into play after the damage is

<sup>1</sup><https://www.apple.com/ios/siri/>

<sup>2</sup><https://www.google.com/search/about/learn-more/now/>

<sup>3</sup><https://www.microsoft.com/en-us/mobile/experiences/cortana/>

<sup>4</sup><https://www.deepmind.com/alpha-go>

<sup>5</sup><https://www.ibm.com/watson/>

<sup>6</sup><http://www.shift-technology.com/>

<sup>7</sup><https://www.rightindem.com>

<sup>8</sup><http://www.motionscloud.com/>

<sup>9</sup><http://www.controlexpert.com>

<sup>10</sup><http://www.cognotekt.com/>

<sup>11</sup>[http://www.sas.com/en\\_us/industry/insurance.html](http://www.sas.com/en_us/industry/insurance.html)

<sup>12</sup><http://ibm.com/analytics/us/en/business/fraud-protection>

done. Instead of paying for treatments that are costly for the insurances and unhealthy for the patient, it would be beneficial to invest in prevention and early detection of diseases and risks. One can thus employ the data that was used beforehand to assess the risks, to then lower the probability of damages happening to the insured and in turn the insurer.

*Atidot*<sup>13</sup> develops a platform for actuarial and risk management using machine learning techniques. To do so, they work with more data sources than simply the demographics. These can be telematics, wearables, social media, weather, or news that are inherently dynamic and subject to rapid changes. *FitSense*<sup>14</sup> offers a data analytics platform collecting users' health data from different devices. This data is then analyzed to build user profiles. A white label health engagement app has been launched as a first product that enables insurers to offer their own self quantification, health management and incentive program. *FitSense* is currently developing underwriting and direct purchase of insurance products based on the data collected and analyzed on the platform which can be utilized to assess customer health and offer tailored products. *Dreamquark*<sup>15</sup> uses sophisticated machine learning models such as deep neural networks to analyze medical records, structured and unstructured data, to achieve a paradigm shift from care to targeted prevention. *Big Cloud Analytics*<sup>16</sup> offer a health analytics platform collecting data from wearable devices and analysis those to help bring the data to action, including health scores to assess and work against the risks.

**Marketing and Customer Experience** One important part of marketing is managing customer churn and improving customer experience. *Adteligence*<sup>17</sup> analyses the cross-platform customer usage data and statistics to learn detailed customer profiles to be able to offer personalized content and only relevant products. This improves customer satisfaction and churn probabilities. *Brolly*<sup>18</sup> is personal insurance concierge for customer interaction and portfolio management. It collects all of the customer policies in one place and provides easy access to all necessary information. The policies are analyzed and compared to the customer needs to determine whether the cover is appropriate, that is, whether she is over or under-insured, and whether the cover should be purchased.

**Chat Bots** The most used apps nowadays are messaging apps and thus it seems to be the most direct and natural way to interact with the consumer using virtual assistants. Natural language processing and sentiment analysis are essential for automatically processing customer concerns and wishes, and addressing those in a personalized way. *Cognicor*<sup>19</sup> offers an intelligent customer service assistant that can be addressed in a human like conversational interface. It is not only limited to customer care to answer consumer questions, resolve complaints and claims. It can also offer tailored products and services by analysing customer intentions. *Conversica*<sup>20</sup> is a virtual sales assistant that leverages artificial intelligence to automate the lead conversation. It engages with the customer using tailored requests, analyzes the responses to find the right sales opportunities that are forwarded to the sales representatives, and follows up on the lead.

There are also a number of medical chat bots. *MedWhat*<sup>21</sup> is another virtual medical assistant leveraging deep learning to provide a "doctor in your pocket" that can answer health and medical questions using the consumer's Electronic Medical Records. *Babylon*<sup>22</sup> offers virtual consultation with the intention to offer affordable healthcare to every person on the planet, especially those that do not have access to other sources. *Your.MD*<sup>23</sup> is a personal health assistant that asks about symptoms and give advice based on the conversation.

**Telematics** Telematics is one of the areas with a high expected impact on the insurance industry. One such company is *Octo Telematics*,<sup>24</sup> providing telematics for the auto insurance industry. Carriers are already offering black box tariffs, giving discounts based on the frequency and times of driving, the mileage or the driving style. In the future, however, we will additionally be able to recognize patterns in the GPS data, infer the road and traffic conditions and in turn even help to avoid accidents, leading to increased customer satisfaction and a reduced number of claims.

**General Machine Learning Frameworks, Platforms and Libraries** Next to these mostly specialized companies and start-up, there are a number of general purpose machine learning providers and cloud providers with machine learning capabilities, that are very attractive to have a peak into the possibilities, especially if you are using the infrastructure already, given the sheer amount of data.

Microsoft has extended its *Azure cloud-computing and storage platform*<sup>25</sup> with a machine learning service. *Azure ML Studio*<sup>26</sup>. Using a wide range of available algorithms, you can build, train and publish models, for use with your other services. Microsoft has also made its *Distributed Machine Learning Toolkit*<sup>27</sup> openly available to developers, to be able to scale machine learning algorithms by employing more machines, and the *Microsoft Computational Network Toolkit*<sup>28</sup> with the ability create and train neural networks with many CPUs and GPUs in parallel. *Amazon Machine Learning*<sup>29</sup> is a similar service based on *Amazon Web Services (AWS)* server hosting and cloud services. It is not (yet) as extensive as other machine learning services, however, easily integrates with AWS storage and services. *Google TensorFlow*<sup>30</sup> is a machine learning framework designed to scale across multiple machines, employing CPUs and GPUs. The computations of the deep-learning framework are described in a so-called dataflow graph that represents computations, nodes represent operations and the edges are multi-dimensional arrays (tensors), hence the name. *Apache Spark MLlib*<sup>31</sup> is a machine learning library built on *Apache Spark*<sup>32</sup>, being part of the *Hadoop* family. In contrast to hadoop, Spark is an in-memory data processing framework and can be orders of magnitude faster than Hadoop. The algorithms available in Sparks machine learning library are constantly being expanded and revised. *IBM Watson*<sup>33</sup> combines natural language processing, evidence based learning and creates hypotheses to aid in different applications and domains using the input data. Some of the previous examples like the chat bots may well be using Watsons capabilities. *H2O.ai*<sup>34</sup> offers an artificial intelligence framework for businesses. It offers a wide variety of algorithms such as Deep Learning, Gradient Boosting and Generalized Linear Models and can easily be used locally or on top of Apache Spark for efficient and parallel cloud computation. Use cases include risk and fraud analysis, customer retention, and advertisement, among others.

As we have seen there are a lot of question to be answered in the insurance business and AI can find answers to a lot of those. It provides us with the tools needed to tackle these problems by really making sense of the data that has been collected in recent years and lead the industry to making the next step. *insurers.ai*<sup>35</sup> is an artificial intelligence company focused on offering AI services and developing custom AI solutions for the insurance sector. It was founded by Dr. Babak Ahmadi (PhD in Artificial Intelligence) and is a portfolio company of InsurTech.VC<sup>36</sup>.

<sup>24</sup><https://www.octotelematics.com/about>

<sup>25</sup><https://azure.microsoft.com/>

<sup>26</sup><https://studio.azureml.net/>

<sup>27</sup><http://www.dmtk.io/>

<sup>28</sup><https://github.com/Microsoft/CNTK>

<sup>29</sup><https://aws.amazon.com/machine-learning/>

<sup>30</sup><https://www.tensorflow.org/>

<sup>31</sup><http://spark.apache.org/>

<sup>32</sup><http://spark.apache.org/>

<sup>33</sup><http://www.ibm.com/watson/>

<sup>34</sup><http://www.h2o.ai/>

<sup>35</sup><http://www.insurers.ai>

<sup>36</sup><http://www.insurtech.vc>

<sup>13</sup><http://www.atidot.com/>

<sup>14</sup><http://www.getfitsense.com/>

<sup>15</sup><http://www.dreamquark.com/>

<sup>16</sup><http://www.bigcloudanalytics.com/>

<sup>17</sup><https://www.adteligence.com/>

<sup>18</sup><https://www.heybrolly.com/>

<sup>19</sup><http://www.cognicor.com/>

<sup>20</sup><https://www.conversica.com/>

<sup>21</sup><https://www.medwhat.com/>

<sup>22</sup><http://www.babylonhealth.com>

<sup>23</sup><https://www.your.md/>