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WILL TECHNOLOGICAL SOCIETY BE INHUMAN?

Abstract: First part of the paper reviews the predictions of futurologists given in the early 20th century about perspective of the human society at the beginning of the third millennium. These predictions were mainly influenced by the context at the time and therefore had led to erroneous extrapolations. Another problem was the overestimation of human altruism and understatement of selfishness. Nowadays, the future technological society is also predicted based on current observations. Extrapolating our experience leads to the assumption that the future society will have more negative and inhuman characteristics than the present one. We have reached a consensus that the future society will entrust greater impact to machines in everyday human activities. This further increases the anxiety of most futurologists about future trends and symbioses of human society and machines. However, we will show in the paper that the machine analysis can give more human decisions than the ones made by humans, i. e. the ones based on human knowledge, experience and intuition. It can be therefore assumed that some aspects of future technological society will be positive and more human than those run by us.

Key words: *State observer, filtering, estimation, prediction, detection, Kalman estimators, 538 model*

The solution of our problems does not lie in destroying but in mastering the machine.

Nikola Tesla, 1890.

INTRODUCTION

Predicting the future is deeply rooted in human nature since the Pythia and oracle of Delphi to these days, attracting all from charlatans to the wisest minds of the time [1]. The first attempts of scientifically founded prediction with technological dimension can be traced back to ancient Greece in the famous Antikythera mechanism [2]. This mechanism was essentially a sophisticated calendar that was able,

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among other things, to predict some astronomical phenomena. Since then, the predictions have always been more accurate if they were related to natural phenomena caused by natural deterministic mechanisms and much less accurate when related to the social and sociological phenomena that can be modeled by stochastic systems. The accuracy of the predictions is always related to the amount of data at disposal, and understanding of the current and future social discourse.

In the first part of the paper, we discuss several predictions about current events and try to answer why they were essentially wrong even when the trend of changes was correctly estimated. The second part reviews the current considerations of the future impact that technology will have on the development of the human society. The dominant opinion is that the new technological society will be less humane than the current one and that it will lead to further human estrangement. Also, almost all predictions suggest that technology driven, automatic or machine decision will be worse for mankind and less human. However, we demonstrate that some of systems that are already in use, such as systems for automatic recruitment of human resources, point out that the machine-made decisions are sometimes (statistically) more humane than those made by humans themselves. Therefore, we draw the conclusion that not all aspects of the technological society need to be inhumane.

The paper is organized as follows. In Section II, we consider past predictions of the human society development and, in particular, forecasting technological progress. In Section III, we provide a brief review of scientific methodologies used for prediction/estimation/observation system state. Section IV provides some attractive new applications in sociological and political sciences for observation and prediction. Section V considers the usage of the estimator/observer systems at two cases: novel employment methodologies and targeted election campaigns. We show that decisions of such estimator/observer system are more reliable and they could be more humane than decision based on human experience and intuition. From these case studies, we conclude that the technological society could have more human characteristics than the current society.

1. PAST PREDICTIONS

Predicting the future is a favourite pastime, probably as old as the human society. The first data on the forecasts and professionals forecasting the future can be found in ancient Egypt. Almost all religions have dealt with predicting the future. In ancient Greece, there was the oracle of Delphi with the famous propheteess Pythia [1]. Some assume that legendary predictions were based on analysis of events and data and analytical estimates of outcomes. The roots of the first scientific method for predicting the future can be found in ancient Greek civilization. The Antykythera mechanism was a sophisticated calendar with the ability to predict moon phases, the cycle of the Olympic Games, dates of solar and moon eclipses [2], etc. There are historical traces that the "prophecies" based on this or similar mechanisms are used to prevent wars.

Modern people are more self-confident because we feel that our knowledge allow us to more accurately predict the future. Therefore, in order to judge current estimations, we will analyze some predictions about the modern world made in the past.

The first prediction we are considering was published in 1911 and referred to the period of one century [3]. Fortunately, many predictions from this reference did not occur. We still have mosquitoes and flies, mousses and rats, wild animals are still at large and not only in zoos, etc. Some forecasts related to the food production partially came true since the trend was estimated properly, however with the obtained results far below the predicted ones. One of the predictions was that the human goal would be to eat as much canned food as possible, since it was considered more healthy than the non-conserved one. It is obvious that the large portion of worries of that time were related to health, agriculture and food production, and these problems led to the consideration of such issues as the most important, which in turn affected the predictions about the future. In addition, it was assumed that the human health will be demonstrated through excellent physical abilities "anyone who cannot run 10 miles will be considered unhealthy". Free of charge and widely available education, from the lowest to the university level, was predicted as well. Energy-related predictions were concentrated to removing coal-based energy production (today, coal is contributing with significant percentage to the energy production all over the world). Significant progress in hygiene was predicted but a large portion of forecasts has proved unrealistic: elimination of major cause of all diseases, clear, healthy and largely available artificial food. Predictions related to war and weapons underestimated progress. It has been predicted the existence of a relatively primitive armored combat vehicles, aircrafts, etc. However, all these predictions were achieved within just couple of years during the World War I. Progress in transportation means was also underestimated. It was believed that efficient vessels will be developed, able to cross the Atlantic Ocean in just two days. "Flying boats" were also predicted, but assumed too expensive to be in wide use. The prediction related to population of the United States of America went up to 500 million people, which is not achieved due to smaller birth rate and immigration slowdown.

Perhaps the most famous prediction of current events was from 1931. when the New York Times on its 80th anniversary requested from few most respected scholars of the time to predict developments in 2011 [4]-[11]. The authors were Henry Ford, W. J. Mayo (founder of the Mayo Clinics), anthropologist Arthur Keith, chemist Arthur Compton (Nobel laureate), chemist Willis R. Whitney, Robert Millikan (Nobel laureate), electrician Mihailo Pupin, and sociologist Willie F. Ogburn. Many of predictions given by these geniuses were quite wrong. First of all, the predictions applied mainly to humanity and generosity of human society. On that basis, Pupin predicted a society with a uniformly distributed wealth. Compton anticipated that the development of the telecommunications would destroy state power and governance based on geographical concepts. Regardless of the progress, the world is still ruled by states and other geographic categories (today many futurologists foresee a world without borders in the next few decades). Ogburn assumed that there will be a strengthening of feminism, that life of women would look like that of men, mainly

spent outside home. He believed that the United States will have about 160 million people (this is a significant mistake) and that the environment will be protected by reducing the number of farms (true), but it would also lead to a reduction in land used in agriculture (wrong) and that most of the U. S. will be covered with dense forests (wrong). Some of predictions are quite similar to those given by many futurologists today, such as achieving the maximal number of workforce, aging society, achieving efficiency at unimagined scale and strengthen the government especially in terms of employment. Mayo gave excellent predictions related to the increase in the life span. He assumed that life expectancy will reach "biblical proportions" and that will be as much as 70 years (in time of prediction it was about 58 years). He was mistaken because the expected lifespan in the USA in 2011 was about 76 years, whereas in some industrialized countries it was above 80 years. Keith predicted further specialization in medicine. He said that in 1851. there had been only three specializations and in time of prediction fifty. In future, he expected that this "negative" trend would continue. Robert Millikan predicted that the science would be able to solve all problems within 80 years.

Forecasts from 1965 were under significant influence of two world wars, cold war and the space race, but also of rapid development of science and technology, space technology, dawn of modern information and communication technologies etc. [12]. All these developments convinced people that the next fifty years would bring dramatic changes in all aspects of society. It was believed that the dream of every man was to have suits of clothes made of artificial materials, some of them for single use and some of them for decades. Also, provided are dramatic developments in technology "which may not in the next 30–40 years but quickly connect the human mind to a computer, and lead us to commercial space flights". Medicine is seen as an area that will, in a few decades only, lead to an increase of life expectancy to 150 years. Futurists provided vision of artificially grown organs for human body. Anticipations regarding the possibility to predict sex of babies in mother womb were achieved, but predictions related to genetic engineering and possibility of human modification of organisms through genetic engineering have not been fulfilled until now. Mass famine in sub-Saharan Africa caused reemerging forecasts that the industry will go towards artificial food products which are supposed to be full of healthy proteins, minerals and enzymes. Prediction that human society will achieve great success in geoengineering creating processes that will inject active ingredients in environment able to reduce pollution and radioactivity are still far from reality. Predictions related to creating artificial moon that will radiate light during the night are not fulfilled.

In the light of previous predictions, we have reviewed several recent predictions about future trends. Technological predictions from 1996. try to guess the next 110 years titled "110 estimates for the next 110 years" [13]. Short term predictions made by the technological giant IBM for couple of years covering various human activities are issued annually and called 5 in 5. These estimates have relatively long history and we can trace their relative success. Many of these predictions given for a short period of year or two have lots of failures; on the other hand, there is a signif-

icant number of excellent guesses [14]. A good starting point for the actual predictions of future can be found in [15] given by famous theoretical physicist, futurist and popular science writer Michio Kaku.

It may be noted that all current sociological predictions assume dramatic demographic changes, self-sufficient man, and further seclusion and anxiety. There are also frequent predictions related to the dominance of machines over men. It seems that all predictions have been shaped by current trends and experience of anxious society, news about young people spending most part of the life in a virtual world, and other pathological trends.

Numerous other estimates, made by famous individuals, some of them still drawing significant attention, can be found. Quite interesting and accurate estimates were made by Isaac Asimov, famous science fiction author [16]. Predictions made by Nikola Tesla are particularly interesting to people from our region [17].

What is common to all of these evaluations? They are based on intuition. Forecasts were significantly affected by the trends and concerns of time they were made, i. e., they were significantly influenced by dominant themes and discourse of the time of prediction. Today, we are witnessing that the media exploits news with negative impact and probably these bad news cause "negative bias" in predictions. Forecasts often ignore human nature, greed and the ability to adapt to circumstances, whatever they are. Also, the estimates substantially ignored the willingness of government to invest in wars, but they overestimated the ability to develop other technological solutions. The latter is probably influenced by advertisement of potential scientific outbreaks that intend to attract investments in some attractive scientific fields raising unrealistic expectations. Another reason for the overestimation of expected technological development lies primarily in the fact that predictions commonly ignore negative implications of these developments. For example, we can mention excessive expectations about the quality of "artificial food products". The third reason for the overestimation of expected technological developments is that the predictions commonly underestimated various problems in implementation of technology. Indeed, today we can all have a personal aircraft, but this would imply extreme costs and energy consumption. Often, even when the predictions correctly guess trends, it was not easy to guess exact outcomes. As we have seen forecasts of the U. S. population ranged from 160 million to 500 million. Similarly, current forecasts predict human population on Earth between 7 billion to 16 billion at the end of this century.

It is worth to point that the predictions related to the field of specialization of some persons have often been amazingly accurate. Mention that Mayo predicted growth of average life expectancy to "whopping" or "biblical" 70 years at the time when it was only 58 years (he underestimated progress for 6 years).

This concludes the review of predictions. It is indicated that the predictions of near or distant future are more accurate when they are based on a sufficient amount of information and scientific settings. Therefore, in the following section, we will introduce some of the scientific techniques used for prediction/estimation process in technical sciences.

2. OBSERVATION, ESTIMATION, FILTERING, INTERPOLATION, PREDICTION

State observer is by definition a device (or system, software or algorithm) that measures some system inputs/outputs, and based on them makes a decision on the inner states of the system [18]. The system observability is related to the level of confidence in estimation of internal states of the system based on the measurements.

Detection is a process of guessing whether a signal/phenomenon exists in some recordings or not. One example is radar signal, which could contain a component representing return from a target [19].

Filtering is a process, method or device that performs the elimination of undesirable components from the signal. Often the undesirable component is random process (noise), but it also can have a deterministic character [20].

Estimation is a process which aims to evaluate some of characteristics of the considered phenomenon. Prediction is similar process in which we predict future values of a phenomenon based on the current observations, i. e. trends [20].

Interpolation is a technique that, based on measurements obtained over certain variables (time, space), performs the estimation of measurements over denser grid of variables [21]. For example, to interpolate temperature measurements obtained at 12 h and 13 h means to estimate the temperature value between these two time instants, say at 12.30 h. Interpolation produces estimates between known observations. Extrapolation, on the other hand, is the process of estimating the measurements beyond the original observation interval. In general, the interpolation is significantly more accurate than the extrapolation.

Filtering and estimation terms are often used interchangeably but, in general, they represent different concepts. Filtering is applied to eliminate stochastic and deterministic disturbances in the measurements, whereas the estimation is used for evaluating the signal characteristics. However, these two methodologies are often combined with one another. For precise estimation, we usually need some sort of measurement prefiltering, and for filtering sometimes we need information on the estimated parameters of some process. Obviously, the filtering/estimation terms are related to the interpolation, whereas concepts of extrapolation and prediction are related with each other.

The estimation theory (basic techniques for estimation, filtering, and prediction) was proposed by Rudolf Emil Kalman. He has received numerous major international awards including the IEEE Medal of Honor, the Kyoto Prize, [22] etc. The Kalman filter (technique) is essentially developed for observations corrupted by Gaussian noise, for linear systems, but it has been extended in many respects during the time. Kalman's papers and books have been cited tens of thousands of times; even more, some fundamental papers addressing the limits of Kalman theory have opened numerous other new research fields and topics.

Here we want to briefly mention some of the areas where the Kalman technique and its offsprings are used for various problems in almost all areas of technical (but also in other) sciences: Linear filters (for example, moving average filter), weighted

filters (with fixed parameters, adaptive, adapted etc.); Nonlinear filters, weighted filters (with fixed parameters, adaptive, adapted etc.); Interpolation using polynomials and other functions; LMS and other linear and nonlinear techniques; Neural networks; Fuzzy systems; Genetic algorithms; Various artificial intelligence techniques; Feature extractors; Particle filters; PHD filters; Bayes filtering and estimation techniques; Blind source separation techniques; Random search trees; Wiener filters, and many more others.

We will now give a few examples of some of these techniques applied in political and sociological studies, outside the primary engineering and technical sciences problems.

3. SIGNAL-TO-NOISE 538 ELECTRORAL PREDICTION

Although the techniques for observation/estimation/filtering have been used five decades in technical sciences and related fields, they have recently attracted significant media attention due to applications in social sciences. Nate Silver has launched a blog http://fivethirtyeight.blogs.nytimes.com [23], [24] to predict the results of the USA presidential elections. This blog has been widely criticized from the right-wing/conservative fraction because it predicted the victory of Barack Obama in both election cycles. The technique used by Silver is relatively simple. He uses the existing measurements, polling data, that are publically available. Measurements (rating of candidates) were obtained from different pollster, with a variety of methodologies, various publically available parameters and settings (some information related to methodologies are not available), at the level of particular states or on the national level, with measurement (sampling) at different time instants. Note that the blog title implies that candidates are competing for 538 electors received for victories achieved in all US states. This technique with state parameters, pollster and sampling instants showed excellent results in the last two presidential election cycles with the exact number of obtained electoral votes and with margin of error in the second cycles of level less than 0.1% in total vote share. Excellent results were obtained in the estimation of Senate elections (significantly smaller number of measurements), and finally good estimates were obtained for elections for governor mansions and House of Representatives (extremely small number of measurements). All details of the observer/estimator are not known, but it is likely we are talking about a system with different weights for pollster, and forgetting factor that prioritize predictions closer to elections. Also, we guess that some of public opinion polls are eliminated by censoring (those that are significantly different from the other, i. e., statistical outliers) and some sort of bias reduction is probably implemented for partisan pollsters. All these assumptions are common for observer/filter/estimator in engineering applications. Often, tools used in technical sciences for a long time gain overnight popularity in other scientific fields after a demonstration of their great possibilities.

To be honest, these systems were initially not so popular or easily understood even in technical sciences, except when it was clear they give excellent and obvi-

ous results. One such system, where it was clear that the filters/estimators can be used, was in the early 1970 s when scientists managed to separate a weak heartbeat of babies from maternal ECG recordings [25]-[27]. On the other side, in a power system, it was not an easy task to convince the engineers that the result of observer stations is more accurate than the actual measurements. Specifically, averaging and processing results from various measurements could produce more accurate results than the actual measurements. In order to show to operators in a power system that this works correctly, in early days there were double screens, one with the processed data and one with the original data. Operators were slowly convinced that more accurate data are received from the processed data. In the monitoring of power systems, we have measurements of different physical quantities, in various branches and for considered time instants. Also, between various values there are deterministic connections (common physical laws in electrical circuits). We do not have different pollsters, but measurements of individual branches and nodes (states). Here, the history of measurements is not important as it is in public opinion polls; instead, we are obtaining more estimates through physical relationships related to powers, voltages and currents [28].

Situation is different in digital image filtering. We have a single realization of a noisy process. Then, for filtering image at considered pixel, we use neighboring pixels as multiple observations of the same process. The linear filtering is applied if the noise corrupting data is the Gaussian one, whereas non-linear filters are used for the impulse noise environment. Therefore, instead of more pollsters, we use pixels in close proximity of the considered pixel. These neighbors also play role of polling at different time instants. The biggest challenge here is the fact that pixels close to image edges cannot be assumed to belong to the same class. Thus, in this application, we need to determine the size of the adaptive local neighborhoods that is wider in flat parts of the image and narrower near the edges (close to edge, large portion of measurements is censored). In the public opinion polls, large flat area with wide adaptive neighbor corresponds to the situation with large number of independent measurements with different pollsters. On the other side, image regions close to edges correspond to large percentage of partisan pollsters [29]. In addition to these adaptive neighborhood techniques, a lot of non-local techniques exist for image filtering, that look for repeated patterns in images (the most accurate technique today is BM3 D) [30]. This corresponds to the determination of the strata in the statistical analysis of populations with similar communities that are geographically separated but with similar political preferences [30].

The third problem we are considering in our research, that is similar to the estimation of electoral results, is locating the measurement units in power systems. This problem has recently attracted a significant attention, especially within the smart grid framework. It is well known that it is neither possible nor economical to have all measurements in the system in all nodes and branches of the energy grid. So the goal is to provide system observability with the least possible number of measurements aiming to reconstruct other measurements based on the well-known equations between the voltages, currents and powers. A small revolution occurred with replac-

ing expensive analog measurements by digital systems called phase measurement units (PMU) [31]. However, user requests for these systems have significantly increased. Namely, it is now a common request for the system observability with missing node or branch measurement (or more nodes and branches). Commonly such requirements increase the number of required PMUs in the system. Furthermore, it is known that current digital measurements are less accurate than the analog ones. Sometimes these measurements can be removed due to obvious mistakes as outliers (censored), but sometimes it is not possible to guess which measurements are erroneous. To maintain the observability of these systems, we need to increase the number of measurements, i. e., PMUs. Finally, the cost of communication between the control center and measurement units can be higher than of measuring devices and it can happen that communication channels are of limited capacity (energy facilities are sometimes far from cities and settlements). In the system design, therefore, we have to take into account the communication limits of available channels. It can be easily concluded that this problem is extremely complex. The problem of positioning devices (PMUs) cannot be solved using simple optimization or iterative schemes. Instead, metaheuristic techniques such as genetic algorithms or ant colony optimization technique are commonly applied. Interesting similarities exist between the PMU positioning problem and election prediction methods. In energy systems, we can establish a deterministic relationship between the measurements and unknowns in some nodes or branches. This is not possible in the case of public opinion poll analysis. However, we can have similar communication impairment like in the case of energy systems, for example when some regions or states are not well polled. The problem of confidence in measurement is similar to the problem of biased, partisan or unfair pollsters. So, as we can see, there is a significant analogy between the well-studied problems in the technical and engineering disciplines, and problems associated with sociological and political research.

Application of observer/estimator/filter model should be performed cautiously since it can produce unrealistic results if the initial assumptions are with limited prior knowledge. This is especially critical in sociological phenomenon but it also appears in other areas. It is, for example, well known fact that the ozone hole over Antarctica was detected only after several years of developing since the data were filtered (some measurements are censored with median filters) [32]. The ozone hole is confirmed in 1985, but the original (non-filtered) data suggest that it appeared in 1977.

4. HUMAN MACHINE SYSTEMS

To reflect the fact that systems in which machine decision making could be more human than the human decision making, we analyze two case studies. The first case study is related to the monitoring of election results. During two election campaigns, the Nate Silver's model and other similar models have shown very small variations in public preference of candidates (election campaign in the USA is rather long). According to the models, there were no significant influence of expensive

party conventions, debates etc. The total variation in both campaigns was within –3.5% limits. It should be kept in mind that such variations can influence election outcome only in several key (swing or purple) states. If this is true, it raises a few questions. Does it make sense to spend trillions of dollars to influence 5–10% of the voters, in a small number of states, which represents only about 1–2% of the electorate? Are these expensive conventions and other similar events needed in campaign? Numerous analysis demonstrate that it is unnecessary to spend truckloads of money for campaign [33], so we are witnessing an increasing impact of technology through the so called targeted campaigns to relatively thin portion of electorate, usually using Internet and other means. Information about citizens and their interests are collected from various public, private databases, social networks and sometimes illegal means and records. They are data mined in order to find what is positive information on the candidate that should be presented to any potential voter, and also what is negative information about the rivals. Other aspects of this analysis could have much broader implications. We do not know whether the Nate Silver's model is correct during a campaign, since it is only evaluated based on the final outcomes. However, the reliability of results of voter preferences and confidence of the Nate Silver's model can be estimated based the Bayesian a posteriory method. We believe that this is very accurate even within a campaign not only on the actual election date. Then, a question can be raised why polling industry shows significant influence of party conventions (convention bounce) and sometimes huge influence of debates. It is a quite important issue if the polling industry or some of pollsters want to attract consumers to their products by advertising such results or even worse that some of pollsters try to influence and affect election results through the presentation of polling data. Obviously, the observer/estimator/filter models that collect data from multiple sources are fairer than any of public opinion polls companies, whereas the sophisticated techniques such as the Nate Silver's one could be future of polling industry, even when information are included not only from polls, but also from other sources such as social networks. This will certainly humanize the election process by reducing the possibility that polling industry influences election results. In addition, the election costs would be significantly reduced by employing more sophisticated and targeted campaigns.

We can conclude that the future sociological and political research have to take large amounts of data that can be extracted about individuals, including information gathered from social networks, and not just the data obtained by questioners, interviews, phone calls (robo – calls), public databases, etc. The gathered data in raw format should be properly processed in order to enable information extraction and decision making.

The second case study is processing of large amount of data for observations, estimation, filtering and prediction in the company recruitment process [34]-[37]. In corporation, the human resources management including hiring, tracking individual performance, promotion and firing is one of the most important business process treated on high level in the company governance pyramid. Methodologies used in the human resources management vary from culture to culture, from coun-

try to country, from company to company. However, it is quite often that there is a special unit in a company working on the human resources management that analyzes CVs, perform testing, interviews etc. The main goal is minimizing risk in the employment process. The process related to reducing workforce is commonly less analytical and more impulsive. The basic features of the employment process are search for: persons with experience, persons with no black spots in career (e. g. without criminal record), persons that have same distinguishing characteristics with respect to other candidates, even if these characteristics are not related to job (e. g. interesting hobby, sport activities, knowledge of some foreign language, etc.) and so on. All these issues are again more related to reducing the risk in employment in order to avoid mistakes and employment of an inadequate person. All other issues related to employment are somehow less important in human-lead employment systems.

Due to the popularization of the Nate Silver's approach, the machine-automatic methods are finding ground in the management of human resources. According to the available data, systems based on the observer/filter/estimator have been applied in the employment of workforce, but also in tracking workforce, processing extremely large data [34]-[37]. Providers of analytical services for work-force had performed over 75 million queries in the USA in 2013. In addition to the analysis based on public databases, these systems use social networks, and, for employees, all kinds of recorded activities within corporate systems are considered, including customer satisfaction, responsiveness to queries and any other information that workers produce. In this way, a large amount of generated data has to be taken into account when the system is designed and decisions are made on hiring, promoting or firing workers. As it can be seen, processing of such huge amount of data and performing analytics is not possible for individuals without the possibility to handle huge amount of data. It leads to founding start-up companies that offer machine/automatic analysis of workers using a model observer/ estimator/filter/predictor. Among other advantages, these systems are less expensive than establishing special human resources departments in the company. Also, these systems sometimes provide counterintuitive results with respect to the existing expert-based methodologies, but also these results are significantly better than those of the existing approaches in terms of hired workers' abilities. In addition, some of results provided by these systems are more human than the existing expert based strategies. Firstly, persons with criminal records, or some obvious problems in the employment history, are commonly excluded from considerations for all responsible and highly paid jobs. However, the automatic systems have shown that these persons are hard workers ready to grab any opportunity; they are more stable and not ready to change jobs frequently. A similar situation is in the Western Balkans countries, where a large population of jobless persons over 50 years, called "the victims of the transition", can be found. These people have extreme difficulties in finding a job, but probably they would grab any available opportunity. Next interesting fact that can be drawn from the already used systems for the analysis of workforce is that the experience is significantly less important than previously thought.

Even, it has been statistically shown that workers with less experience usually perform better. Of course, there are fields in which the experience is extremely important. However, there are industries and jobs in which experienced people are typically inert, unwilling or unable to catch new trends and to gain new knowledge. In these areas, prior experience is rather a drawback than an advantage. The third aspect of this system is related to people with disabilities. To protect this fragile population, many countries in the world have enacted laws that facilitate their employment. However, in the USA, there was a legal dispute between the parents of one of the candidate and the company who perform machine analysis [34] since the system/software used data that are illegal by the law that protects people with disabilities. Regardless of the outcome of the dispute, the plaintiff statement that this novel system provides more employment opportunities to people with disabilities that the existing legal framework should be kept in mind. Finally, the present systems have demonstrated the practical absurd of many of the skills listed in the "polished" CVs. In fact, people adjusted their skills and CVs to be in accordance with requirements of the workforce management in order to maximize the chance of getting a job with no real content behind these activities.

To sum up, the two systems described (in particular, the second one related to employment) make decisions more human than those made by human experts. Therefore, we conclude that the technological society and dependence on machine decision making and artificial intelligence could provide results closer to optimal, but also more human than existing "human" procedure carried out by experts. Of course, this does not ignore negative implications of technological society, but we only demonstrate that some aspects are not necessarily negative and consideration of future as black and white is incomplete and wrong.

CONCLUSION

In this paper, we reviewed predictions of future trends made by experts over the past century. It is clear that the expert estimates are more precise for areas they know well, but general social trends are often misinterpreted. For example, the estimated population in the USA was in range 1: 3.1, for relatively short period of less than a century, which can be assumed as relatively broad range. Furthermore, the estimates are often based on the current problems at the time. If it was time of famine, infectious diseases, hygiene problems it was assumed that all human efforts will be devoted to solving issues in these areas. Common sense rule that solving one problem typically introduces a number of new problems had been completely ignored. Largely underestimated had been the ability for development of military tools and weapons, while overestimated the ability of people to develop technologies for common good. Human greed had been underestimated, but also the ability of humans to adapt to any circumstance.

Assessing a close or far future cannot be successful if it relies on intuition only. Only scientifically founded techniques that consider large amount of data and proper processing of such data, can give satisfactory results. Therefore, trustworthy pre-

dictions are only viable through machine/computer processing algorithms that can output suitable solutions.

Finally, we present two case studies where the state-of-the-art techniques in the field of observation/estimation/filtering/detection of large amount of data are used in social sciences. It was demonstrated that the obtained solutions are closer to optimum than decisions made by humans. Also the obtained results are more human and more publically responsible than those performed by experts. Therefore, we can assume that such problems would need some machine-automatic procedure that will have more objective results that those made by human experts. From these case studies, conclusion can be drawn that some aspects of future technological society will be better than that of current society lead by human stereotypes and experience. Future technological society should be criticized cautiously knowing that future will not change only in direction of efficiency, but perhaps in a more humane way of decision making.

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