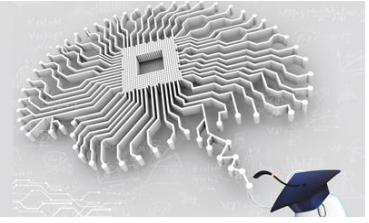


ARTIFICIAL INTELLIGENCE IN EDUCATION WORKSHOP



ARTIFICIAL INTELLIGENCE IN EDUCATION WORKSHOP-2 FINAL REPORT

The Workshop of Artificial Intelligence in Education-2, which was titled as *Using Genetic Data in Learning Environment*, was conducted by The Institute of Education, Industry and Technology (ESTEN) in İstanbul KWORKS- Koç University Entrepreneurship Research Center on **16th of January, 2019**.

The workshop, moderated by Dr. Sevinç TUNALI, involved a presentation by the director of Genomedis Genetics & Health, Dr. Sevgi Salman ÜNVER. Through the presentation, the genetic factors that affect learning were discussed and current researches related to this issue were shared with participants.

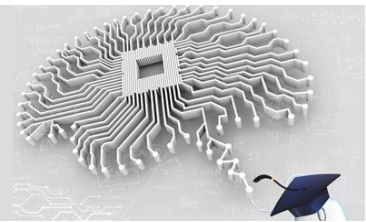
As indicated in the Final Report of the First Workshop of Artificial Intelligence in Education (<https://bit.ly/2NLJEMk>) the very first step that we must take for the artificial intelligence systems to be developed for the use in educational environment is data collection.

Data can be collected from several different sources. For instance, it can be oriented into characteristics of an instructor, conditions of the educational environment, effectiveness of the education method or characteristics of the learner. Each field provides significant clues with regard to learning in itself; and, the current state in each of them must be known to be able to explain one of the cases.

The most important reason underlying usually getting the mistaken results of decisions about education and frequent changes in education is the fact that the decision made does not focus on learner, instructor, learning environment or instruction method; but focuses on only one of them. Consequently, an intervention which does not comprise alternative situations cannot be as influential as expected.

In order to start the study, if the measurement of the learner characteristics is taken into consideration in the first place; measurements can be made on different variables such as intelligence, interest, motivation and success. However, these measurements have a risk of changing from one measurement to another because of the individual's own development, the characteristics of the test and the environmental factors.

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In today's technology, determining the genetic characteristics of the learner brings great ethical debates with it on the one hand; on the other, it is perhaps the easiest matter to determine since the genetic material never changes from birth to death.

The cost of the tests to identify gene sequences in a human being was at a level of million dollars in the early days of genetics studies. Yet, at the present time, the cost has decreased to the level of 100 dollars in some companies (23 and Me, Genos, Veritas Genetics, Ancestry DNA, Living DNA Review, Home DNA review, My Heritage DNA, etc.). In fact, people can attain a lot of information about their genetic constitution even without leaving their house; it is possible with a drop of saliva to be placed in the sampling tool in the box which was shipped by cargo.

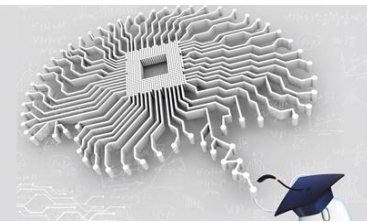
Today, many parents, especially parents from families with a high risk of genetic disease, apply tests to diagnose genetic diseases before birth. The increase of awareness about these issues day by day brings to mind the questions of "How likely is it that increasing number of estimation methods which are cheaper, which give faster and more reliable results affect education?", "How can the data be collected, preserved and used?".

Researches that were conducted on 240,000 people show that there are 22,000 genes in a human body. Genetic studies have focused especially on "intelligence", which is seen as a learning capacity. Researches have been identified the existence of 500 genes affecting the learning potential out of 22,000 genes. These genes are related to some features like "intelligence", "some personality characteristics", "five sensory acuity"; and, these genes have the potential to be activated or to be kept recessive depending on the environmental impact. The presence of one or more of the 500 genes identified in a person does not mean that they will have a superior-high intelligence or a special talent.

One of the main purposes of the educational environments is that an individual's learning and developing skills within a program that has been determined for her/him or that s/he has arranged by himself/ herself. In order to learn or develop a skill, the newborn human infant has two determinant factors. One of these factors is genetic and the other is the environmental (epigenetic) factor.

Recent researches have deduced that the genetic factor on intelligence is effective at 60% level, whereas the environmental factor is effective at 40% level. While scientific studies have been

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trying to explain the effects of genes on intelligence, which is regarded as learning and learning capacity, it has been seen that the effect of environmental factors is at least as important as the genetic basis.

In addition to this information, the effects of genetic factors on intelligence can be seen more clearly in conjunction with age- going from childhood to adulthood. By taking into consideration these reasons, it can be assumed that only the individuals being supported by appropriate environmental conditions that will lead to the existence of genetic predispositions can actualize their capacities at the highest level.

The Human Genome Project (HGP), which began to do its researches in 1988, has set an example for many scientific studies. Over the past 30 years, gene studies have come a long way from generating more intelligent, healthier, faster etc. babies to the preparation of personal treatments and personal medicines. The utilization of genetic data for health is one of the most important issues that occupy a place in the agenda of the health sector.

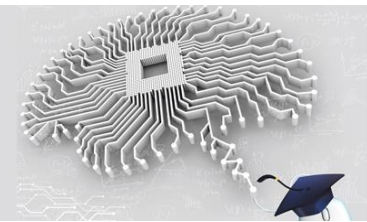
Collection of data that have an influence on learning processes such as data collected for personal treatment methods can be served as an example for personal education. Then, is it possible to carry out the procedures, which are conducted for the collection of bioinformatics, for education? If we consider the potential of cheaper and easier access day by day, what can keep us away from taking a DNA test, of which price decreased to 10 dollars in a decade and which involves a “report of learning potential”?

The topic has been analyzed under three subtitles to be able to explain the questions just as “What should we do if we face with the people, who are like today’s parents’ having their children taken intelligence tests and coming to schools by declaring their children have a superior-high intelligence, that come to the schools with these test reports?”, “Is this a scenario which can be prevented or should be prevented; or, is this a situation that is extremely possible and extremely soon?”

1) Technical Information

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Developments in the field of genetics have progressed in the identification of genes today. “It is not just the detection of genes that can cause disease in the advancing ages, but changing them”, “the selection of the embryos with healthier genes and being born of those genes” are examples for the ordinary news. The fact that human DNA has turned into rewritable information from a readable information has enabled to the production of “specially designed” people. The knowledge for being able to do “gene design” like creating a new genetic information, designing an artificial gene, and altering a part of an already existing genetic information has been produced thanks to the fields of molecular biology, engineering and bioinformatics. This information has initiated a major transformation in the health sector; and, it has the potential to influence other areas such as education in the near future.

2) Ethics

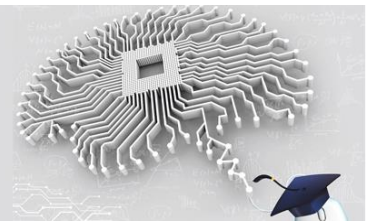
The news about generating babies who are more resistant to some diseases as a result of intervention to embryos with the CRISPR-Cas9 method has been widespread throughout the world. These researches, which are thought to have been made in a kindly and humanist way, have caused great social problems in some periods of history. The serious problems that the scientific community known as “Eugenics”, which was established with inspiration from the ideas of Francis Galton, who worked on intelligence and the hereditary effects of intelligence (1883) caused in society cannot be ignored.

It had become a government policy in the USA to intervene the African-American people - without giving information- in addition to the mentally-impaired, visually-impaired and hearing-impaired people under the name of “genetic sterilization” at the beginning of the 20th century. Similar ideas also lie behind the genocides in Europe during the World War II.

Although the utilization of genetic data in education is technically possible in today’s conditions, the ethical debates and the inability to make an estimation about the way using the information properly constitute the greatest risk. There is a very high risk of making decisions that will deeply affect the social structure like having people with certain genes special trainings and making a separation of those who have less of the desired gene sequence. The fact that there is not a consensus on confidentiality in the collection of genetic data and personal information and prevention of misconduct is the biggest threat to the scientific studies.

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3) Systemic Operation

It is possible to create educational environments in which individuals can maximize their potential by revealing genetic predispositions. Theoretically, even if it is possible to collect genetic data and support them with an organized educational environment for the reveal of genetic predispositions, this will necessitate a completely new order within the general system of education.

Another important issue is the processing of the collected data. Since it is not possible to process the collected data with simple operations, the use of artificial intelligence systems in these regulations in the educational environment is extremely important in decision-making and in determining alternatives. It will not be possible to use the collected data effectively if it cannot be modeled.

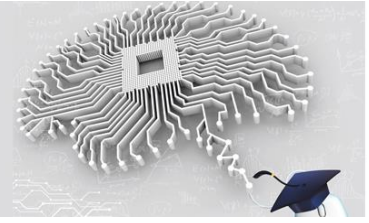
As a summary, the information we receive about a child, who starts school today, in order to determine qualifications of the learner is such limited to credentials and basic family information that this information does not give the slightest clue about either the learning potential of the child or the educational life of the child in the future.

If we suppose that the main purpose in education is to “ensure the potential of the learner to develop at the highest level”, the genetic characteristics of an individual can be determined in order to increase performance of learning, identify strategies that will enable faster, easier and deeper learning.

Can genetic information enable us to reach those who have completed their educational life without being aware of their own abilities within the education system? For instance, can this information be used to give a chance to those who have the genes that constitute the musical talent but have lived until now without even touching a piano?

While the personal characteristics in the genetic basis, the five sensory acuity and the characteristics determined by the learning potential can be a starting point for the personalization of education, it will also lead many ethical debates to emerge.

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Due to the fact that not every country, every university, every research center has the same technological facilities for gene studies, those who has this information has also the power to control it. This power can be used in various ways; from producing a genetically modified human being to creating an appropriate educational environment that will reveal the genetic basis that an individual has.

The studies on the construction of future learning environments have shown that; the transition from mass instruction to personalized learning is not possible to regulate and manage with mere human labour. Therefore, new algorithms for education will be required in order to plan the learning process of the learner characteristics.

Reporters

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Dr. Sevgi Salman ÜNVER, The Director of Genomedis Genetics & Health