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CONTENT

A New Method of a More Efficient Filtering out Persons Using Performance Enhancing Drugs in the Defence Sector

(the possible position of measuring CDT% in persons potentially using anabolic substances)

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Abstract

During the regular medical check-ups, physical and psychological tests the performance and current physical status of personnel is assessed with the use of indicators allowing fine distinctions, which also determine the courses for further development. It is commendable when soldiers, police officers, or firemen do workouts, develop their muscles, increase stamina, or improve speed every day, but it is not indifferent what the means are to reach this goal. Anabolic steroids, the male sex hormone- and growth hormone-products, in addition to definitely damage somatic health (liver and kidney function, hormonal balance, etc.), have certain non-negligible psychological side effects as well (personality changes, behavioural disorders, derailment of emotional life or aggression-control, etc.). This is why active research of any new method is essential, in order to filter out persons partly or completely unfit for service due to their use of prohibited performance enhancing drugs. Based on our test results of CDT% (carbohydrate deficient transferrin) may be appropriate for producing a more accurate picture of the situation.

Keywords: illegal performance-enhancing, anabolic, CDT%, screening examination.

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Figure 1: Additional muscles and extreme physical performance at the cost of self-destruction by drugs?
Source: https://img.17qq.com/images/gpffqssky.jpeg

Practical use of carbohydrate-deficient transferrin (CDT)

The original use of CDT% was limited to the objective detection of alcohol consumption. The limit of alcohol addiction is 60 grams of alcohol per day for men and 40 grams per day for women. Comparison can often be found with other, traditional parameters, currently used for indicating alcohol consumption, including GGT and MCV values. The use of this diagnostic value of CDT% stems from the fact that it can be used as a marker several weeks after alcohol consumption. It would not replace the use of Gamma-Glutamyl Transferase (GGT) and Mean Cell Volume (MCV), but complement it and refine the sensitivity of testing. (It should be noted that information about a person's regular alcohol consumption is not irrelevant in the case of professional personnel.) GGT is a well-known indicator of chronic alcohol consumption, and before the introduction of the CDT%

method, it was almost the only useful parameter of its kind.[1] Numerous studies have been published comparing these two parameters and the evaluation of other liver function data (Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT), MCV). It seems clear that the best indicator of alcohol consumption is the combined use of CDT% and GGT. This is more sensitive than either one alone or any combination of any of the above parameters. Golka et al. (33) examined 15 parameters of the blood of 100 men who regularly consumed alcohol (equivalent of more than 60 g of pure alcohol per day). CDT%, GGT, and ferritin values changed significantly with daily alcohol consumption. However, the two parameters are not comparable due to some physiological and temporal shifts, because at relatively intact liver function GGT can be reduced to within the reference value even after 3-4 days of abstinence. On the other hand, CDT% monitors a completely different temporal situation since it increases after the consumption of 60 grams of alcohol a day for at least three weeks and has kept this value for three to four weeks.[2] Thus, the two methods complement each other very well and can provide a comprehensive picture of the individual being examined. According to the current position of special literature, both the sensitivity and specificity of the combined use of CDT% and GGT are 85-90%. There is also an agreement in special literature that the combined use of MCV, GGT and CDT% can provide 90-95% sensitivity and specificity in practice. However, CDT% change was found to be the best indicator of testing for long-term alcohol consumption. It is clear from data in literature that CDT% is a better parameter than GGT or MCV for assessing the relapse of alcohol consumption.[3]

Although the increase in alcohol-induced CDT% has already been described in the 1970s (65), the specific mechanism by which this process takes place has not been fully elucidated yet. Based on their detailed literature review, Silnaukee et al. (61, 63, 62) came to the conclusion that alcohol has a multifactor impact on glycoprotein metabolism, which includes both protein transport mechanism and the influence on enzymatic activity. In human hepatoblastoma cell cultures (HepG2), ethanol and its metabolites alter hepatic cell growth, proliferation, and transferrin synthesis (59). Acetaldehyde inhibits growth, phosphomannose mutase activity, and increases the amount of CDT%. The metabolism of alcohol is carried out by three known enzymes, such as alcoholic hydrogenase, MEOS (microsomal ethanol oxidising system) and peroxisomal catalase.[5] In most of the major publications, there is a consensus on the existence of a proportional relationship between higher values of chronic alcohol consumption (60-80 g/day) and the excessive value of CDT%. However, there is less agreement on whether there is a correlation between CDT% and moderate alcohol consumption (recommended, 20-40 g/day). In a 12-week human experiment by Sillanaukee et al. (62)

tested the impact of four alcoholic beverages (red wine, beer, and spirits, equivalent of 40 grams of alcohol) and water, in a randomized, diet-controlled, crossover study, on the value of serum CDT%, sialic acid, gamma-glutamyl transferase and liver enzymes. Surprisingly, it was found that three weeks of red wine consumption significantly reduced the CDT% concentration of the serum. However, other tests did not confirm this, in those cases CDT% value was increased by the consumption of red wine as well.[6]

Presumed connection between prohibited performance enhancing drugs and CDT% value

In our research, an increasing amount of data has been gathered that besides alcohol consumption other substances may also affect changes in CDT%, therefore I consider it important to analyse some unexpected results and to give a realistic explanation for the reasons. The cases described below drew our attention to previously unknown factors that, besides alcohol consumption, seem to be able to influence the percentage of CDT%.[7]

Three cases highlighted the importance of further research into the use of performance enhancing drugs. In the first case, a CDT% test (CDT% = 3.63) was carried out about three months after the termination of the usual use of different protein preparations and pharmaceutical products used by bodybuilders, while in the second and third cases, such substances were continuously consumed before the testing. The consumption of the drugs was neither because of a disease nor doctor’s advice (CDT% = 4.87 and 4.66). Unfortunately, it is a well-known fact that these “athletes” are not very communicative with their physicians, and consultations take place only at the stage when such drugs have already caused serious health damage.[8] We managed to conduct these tests when the involved people have not reported subjective complaints yet. No detailed, comprehensive clinical tests could be carried out, and the patients had no intention whatsoever to receive information on any potential adverse health effects. In special literature only a small number of references can be found which may explain the cases (11, 38, 51).

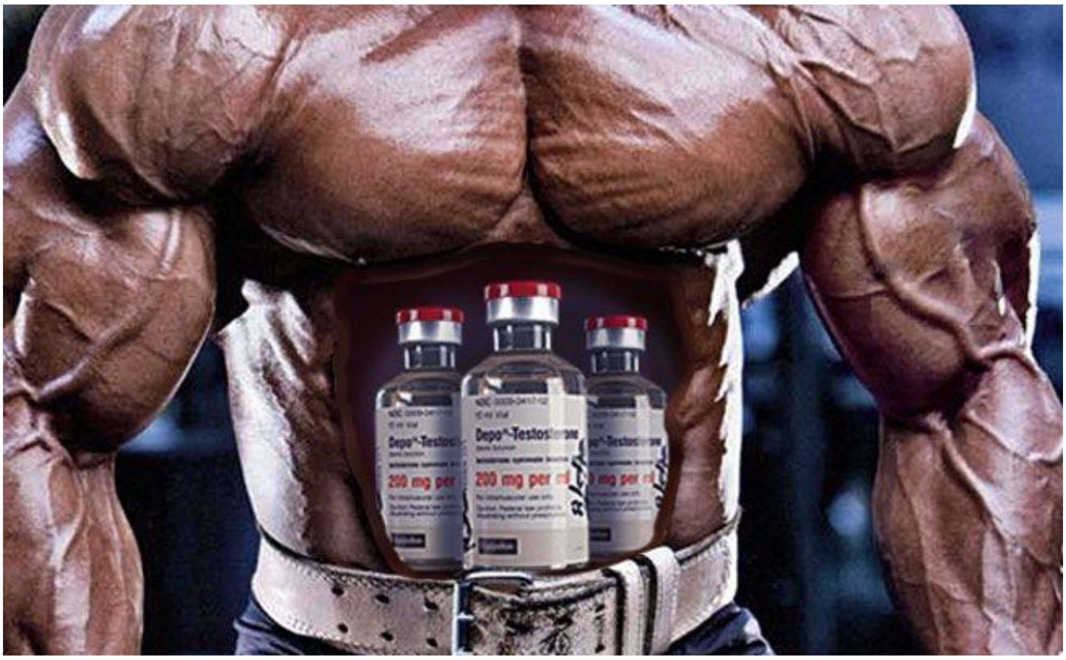

Figure 2: A “sportsman” with “natural” and “healthy” muscles
Source: http://media.new.mensxp.com/media/content/2016/Nov/pressure-on-men-to-look-buff-and-steroid-abuse-652x400-3-1479814402.jpg

Many athletes use dietary supplements and non-pharmaceutical grade substances, some of which are shortlisted as prohibited substances. The effects of drugs and medicine used in competitive sports on CDT% have not been studied so far. In special literature, there is no information on the effect of anabolic steroids and stimulants as performance enhancing drugs on CDT%, primarily considering current physiological compliance. It is not yet completely clear how different drugs and chemicals may influence CDT% values.[9]

Test results from case studies on the use of performance enhancing drugs

In the first case, the person is a 28 year-old male, 185 cm tall, weighs 95 kg, with blood pressure 120/80 mmHg, pulse 70 beats/min. He is healthy, with no known previous diseases, non-smoker, does not consume alcohol, his physical status is adequate for age, physically fit, tolerates physical activity well, currently asymptomatic. He has no known psychological deficits, is employed in intellectual job. He claimed that three months before testing he had been consuming proteins and other food supplements for about 1 month.[10]

The second person is a 28-year-old male, 178 cm tall, with a body weight of 98 kg, blood pressure of 130/80 mmHg and a pulse of 80 beats/min. There is no history of alcohol consumption or smoking, his physical status is adequate for age, he feels good. He claimed to have used materials for bodybuilding for at least 2 months and used drugs and was still consuming them prior to testing.[11]

The third person is a 29-year-old male, 177 cm tall, weighing 90 kg. He has blood pressure of 110/70 mmHg and a pulse of 70 beats/min. There is no history of alcohol consumption or smoking, has no known previous diseases, and feels physically good. About two months before the testing, he began to use bodybuilding proteins and non-drug substances in the framework of the so-called preparation, which he continued during the testing.[12]

Since in the history there were no other known or suspected factors that might have affected CDT%, in all three cases the significantly increased CDT% values compared to those of the reference values for age and gender are the consequences of excessive consumption of dietary supplements and dietary supplements. (Table 3).

	Case 1	Case 2	Case 3
WBC	6200	7700	7400
RBC	5,100,000	5,200,000	5,300,000
HBG	155	152	156
HCT	451	457	460
MCV	89	88	86
Albumin	54	49	47
KN	5.1	7,5	6.4
AST	18	41	28
ALT	21	76	27
GGT	19	18	24
CDT%	**3.63**	**4.87**	**4.66**

Table 1: The laboratory results of the three tested bodybuilders

Table 1 shows that the laboratory results of the 3 examined athletes do not show any difference compared to the domestic reference values. WBC values are normal, red blood cell values, RBC, HBG, HCT, and MCV do not show any significant differences compared to reference, while liver function markers, AST, ALT, and GGT are also within the reference values. Only CDT% shows an increase, which indicates a significant difference in the values compared to the domestic control group.[14]

At recording the history, the value of regular alcohol consumption is to be recorded on the basis of the information provided by the patient. In certain cases, however, people do not report their alcohol consumption to their physician or even conceal it. The situation is the same with the use of proteins consumed without medical instructions or illness, and substances categorised as dopes with potentials of subsequent complications, consumed more and more frequently in our age. In order to prove the diagnosis of diseases of various origins (e.g. liver disease), it may be necessary to have objective parameters that underpin the pathological role of concealed consumption of alcohol or other toxic substances. It may be very important to involve such a marker in order to have a medical expert opinion, such as in military medicine or sports medicine. Determining the amount of carbohydrate-deficient transferrin can facilitate differential diagnosis in such cases.[15]

On the basis of the history or the laboratory parameters shown in Figure 1, the increase in CDT% in the three cases described can in no way be explained by alcohol abuse or other harmful effects or illnesses. The first investigated person is an intellectual, at his job is not exposed to any chemicals, the second and third subjects are employed in a non-intellectual positions, also without any chemical exposure. Thus, the “other” toxicological effect is excluded on the basis of the occupational history.

Changes in CDR% in athletes who consume performance enhancing drugs, and in those who do not

During this research work, the effect of so-called dietary supplements and that of agents in the Prohibited Lists on CDT% was examined with the involvement of athletes of two sports clubs, after providing detailed information to the athletes, participating on voluntary basis. Among bodybuilders it is generally accepted to take anabolic and/or drugs with protein-vitamin complexing agents and dietary supplements. The participants in the study did not deny that they took such drugs regularly, but the preparations were not exactly named, although their active ingredients and their six-month prescription protocol were given. Anabolic agents prolong response time, “slow down the competitor”, therefore, boxers usually do not take them. The six-month protocol used to boost performance by the tested group of bodybuilders is as follows:

1) Testosterone Enanthate: 250 mg per week for 12 weeks. Including:

- 2x250 mg Testosterone Enanthate from the second week.
- On week 11, 3x250 mg of Testosterone Enanthate.
- On Week 12, also known as the final week, 1x250 mg Testosterone Enanthate to reduce water.

2) Oxymetad for 6 weeks. Including:

• 50 mg of Oxymetad on the first week if the competitor weighs at least 120 kg.
• On the second, third, and fourth weeks, the accepted right dose is 2 x 50 mg of Oxymetad. Oxymetad is only taken for six weeks because it is considered to be carcinogenic in longer term.

3) From week 6, Nerobol, 60 mg/day. More precisely:

• The prescribed dose is only 9 pills from week 11.

4) HCG (human chorionic gonadotropin) is 5000 IU, primarily 1.5 weeks before competition.[16]

These products make their users feel pleasant, relaxed, their moods are explicitly good although the values of aggressivity and appetite often increase. However, the most obvious is the feeling of omnipotence, which often changes into aggression. The daily use of such drugs in practice is more varied because it may greatly fluctuate in dependence on financial situation, purchasing opportunities, and current information.[17] However, the tested 15 athletes followed the protocol approved by their coach to an extent of 95%, according to their statement.[18] The measured CDT% values and two important relating laboratory findings (GGT, MCV), which emphasize the importance of liver function in the disposal of various harmful agents, of the non-use and use cohorts are shown in Tables 10 and 11. When examining the results, it can be stated that there is a significant difference between the average CDT% of the bodybuilding and boxing groups, while there is no significant difference between the other two indicated laboratory values.[19]

	Average	**SD**	**Reference maximum**
CDT%	**2.4**	0.6	2.39
GGT (U/L)	42.73	7.3	<50
MCV (femtoliter)	80.35	1.3	<96

Table 2: CDT%, GGT, and MCV values of athletes not using performance enhancing drugs

	Average	SD	Reference maximum
CDT%	**5.4**	1.2	2.39
GGT (U/L)	20.6	4.9	<50
MCV (femtoliter)	88	1.5	<96

Table 3: CDT%, GGT, and MCV values of athletes using performance enhancing drugs

Figure 19 shows the previously presented results and other measured laboratory parameters. The variables shown in the figure, with the exception of CDT%, do not exceed the normal reference values.

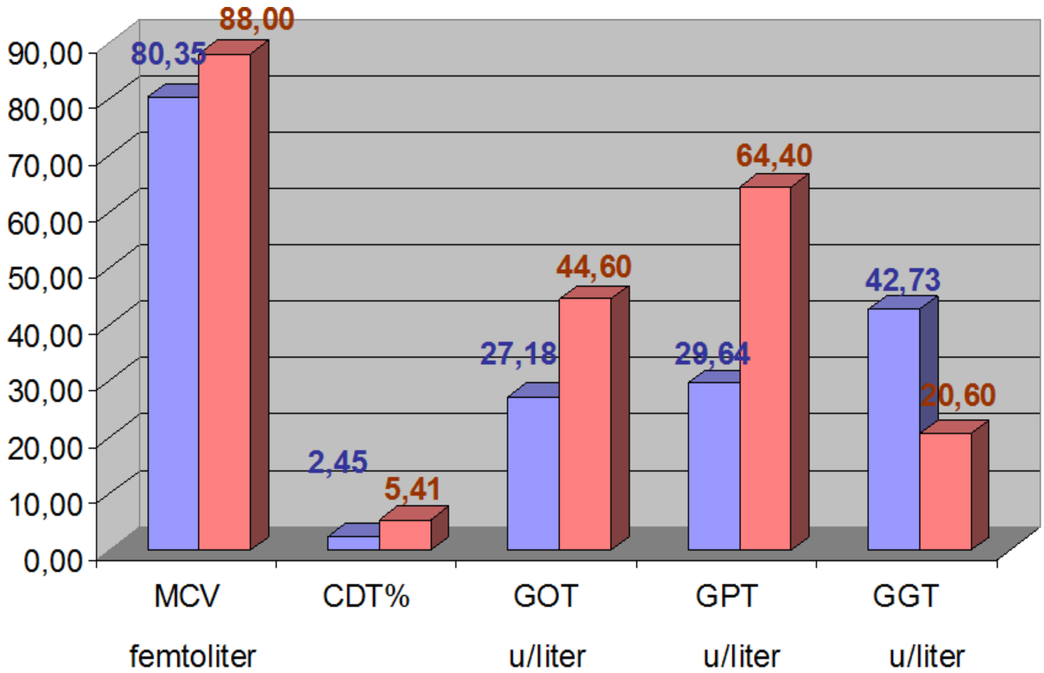

Figure 3: *MCV CDT%, GOT, GPT, and GGT values of athletes using or not using performance enhancing drugs*

Discussion

The results of the two groups of athletes differ only in their CDT% values, and no significant difference was found in other laboratory parameters. In both tested groups of athletes, alcohol abuse could be excluded based on the normal range of MCV and GGT values, and no other haematological or hepatological diseases could be presumed, according to their medical histories.

According to some literature, the rise in CDT% is a very complex indicator of the defensive response of the body. Based on our studies, anabolic agents and drugs also cause a significant increase in the value of CDT%. A comprehensive analysis would include accurate knowledge of the composition of such agents, but some of the athletes do not know them, or the exact product names, considered confidential information, are not communicated for various reasons. Most of the performance enhancing drugs, including anabolic steroids, are on the Prohibited List. At the same time, it should be mentioned as an important observation that in general, agents with a commercially available protein-vitamin complex and off-the-shelf dietary supplements also contain small amounts of doping agents, and therefore the long-term use of these preparations in large quantities may present certain risks.

Since not the same substances were used for the 15 specific bodybuilding products tested, the specificity of CDT% may be low. The details of the specificity determination of CDT% are not yet fully understood, but due to the high sensitivity and low specificity of the method, the result is remarkable and is believed to be suitable for use as a pre-screening test for doping testing. Thus, if someone's CDT% exceeds the cut-off values of those who were abstinent and healthy in the Hungarian population (based on our studies, it is 2.39 CDT%) and was not exposed to any chemicals, it could raise suspicion that the higher-than-normal CDT% value was caused by some performance enhancing drugs. The cut-off values identified in the examined healthy adult population can be used as a reference point in the absence of a better and larger sample. At athletes the values exceeding these values are likely to raise the suspicion of using some type of performance enhancing drug. It may be useful to conduct further drug-specific tests that identify the concrete performance enhancing drug in the case of the filtered out athlete.

Conclusions

When processing the data of the 25 athletes examined, we were able to review the CDT% values and the measured routine laboratory parameters. Based on the athletes' measurement results, we were able to prove that since there was no significant difference between the routine laboratory parameters of the two groups, these data are not suitable for detecting the use of illicit performance enhancing drugs known from the patients' history. However, the significant difference in CDT% between the two groups suggests that this indicator can be correlated with body's responses triggered by the use of performance enhancing drugs, which cause changes detectable with high sensitivity. Therefore, the sensitivity is very high with the use of CDT% for testing, but because the testing is not suitable for detecting the concrete type of substances used, its specificity is low.

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The Artificial Intelligence and the army II. (Discussion system I.)

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Abstract

During the regular medical check-ups, physical and psychological tests the performance and current physical status of personnel

Abstract:

Artificial intelligence deals with a wide range of areas such as expert systems, visual and image processing, natural language processing, speech recognition, and so on. The subject of this article is speech recognition, the field of which can not be left out of the military either from the research directions. In this section the theoretical basics are described, the second part discusses the practical implementation issues.

Keywords: Informatics, IT system, Artificial intelligence, Voice recognition

Introduction

Numerous options have been and are being explored in order to increase the efficiency of an activity through the extensive management of information. A fundamentally new way to increase the efficiency of different types of work could be the use of speech recognition systems to handle incoming information. The use of a speech recognition system can be a step forward in precisely those areas where recent surveys have shown significant backlogs. The practical application of the speech recognition system dates back a very short time and the number of professions in which the conditions of application have been created is still relatively small. The application of artificial intelligence in speech recognition can also mean significant perspectives in the performance of military tasks.

THEORETICAL FUNDAMENTALS OF THE APPLICATION OF SPEECH RECOGNITION SYSTEMS

The speech recognition system results in an extremely high efficiency increase by converting the text spoken at normal speech speed into editable, written text with very high accuracy, almost at the same time as the speech. The essence of a speech recognition system is that with the help of a suitable computer program we can convert even the fastest human speech into a direct typable text form. Of course, the flow of information during the execution of tasks is multi-directional (instructions, clarification questions), so speech recognition software must also be able to multi-directional text conversion.

The regular use of speech recognition, in the case of the speech recognition software already used so far, based on the analyzes, significantly increased the work efficiency, which was determined to be 30-40%. By increasing efficiency, a time savings can be achieved that can be used (e.g. to prepare analyzes even more accurately) to raise the standard of work.

In order to apply, the following preliminary tasks must be solved:

- Speech recognition software must be obtained;
- A dictionary of vocabulary for the field should be developed;
- The speech recognition system must be installed on the computers;
- To train persons wishing to apply speech recognition to use the system;
- Develop and issue a regulatory system for the application of the speech recognition system that should fit the entire workflow.

What are the main benefits of speech recognition:

- Accelerates responsiveness;
- You can improve accurate verbal communication for users;
- It allows you to take advantage of redundant times;
- Improves the quality of typed materials.

Speech recognition is particularly important in areas where there is a very high demand for writing, and unfortunately armies still fall into this category. For a given area, the accuracy of the incoming and outgoing data may not be the determining factor. However, developing a speech recognition system for a given area is sure to be essential because work in those areas usually uses such a special vocabulary set. The speech recognition system fundamentally increases the efficiency of the work by making materials that require very long, written form can be created much faster than traditional typing and retrieved after archiving with traditional computer tools.

Traditional speech technology includes the following four main technology areas:

- Automatic speech recognition determines what words the user has said.
- With the help of syntactic analysis and semantic interpretation, the syntactic structure of the user's communication can be analyzed, as well as its semantic interpretation can be mapped according to the goals of the given system.
- The dialog control implements the appropriate step of the system, the database query, based on the language characteristics of the input, the individual settings of the given user and task.
- Speech synthesis technology is used to that the machine produces the right speech output.

However, if we ask whether speech synthesis, in other words text-to-speech transformation, is solved, we do not get a clear answer. There may be several reasons for this, such as dislike by users, reluctance to use it because it hasn’t brought serious, demonstrable business results to anyone, or just an instinctive distance from technical innovation.

The following can be considered as the basic elements of speech synthesis and the main issues to be solved:

- It is a common basic device that can be a PC, but only with a large RAM, mass storage, sound card, or even a smart phone with similar good features.

- The system of rules for storing, modifying and concatenating the basic elements of natural speech.
- Definition of stored basic elements (eg: complete to be communicated, sentences, words, syllables, sounds).
- How can elements be created that can be joined together well and prosodic elements can be built on it?
- What needs to be ‘reworded’, pre-translated from writing to speech before being read out? The main goal is to be able to “understand” the text mechanically.

Speech recognition has long preoccupied researchers, but the results that can be used in practice have only been achieved with the proliferation of high-performance computers. Speech is a basic and fastest form of human communication, so there are several benefits to understanding human speech by a computer, and as a result, the exchange of information between a computer and a person is accelerated. The use of speech recognition systems can provide new solutions in many areas where the documentation process and information are of paramount importance.

CLASSIFICATION OF SPEECH RECOGNITION SYSTEMS

Speech recognition systems can be classified according to several aspects. One classification aspect may be the size of the text that the speech recognition systems used recognize. Based on this, there can be systems that recognize unique words, phrases, sentences, texts.

Another classification aspect is related to the speaker, which can be based on speaker-dependent (person-dependent), speaker-independent (person-independent) systems.

Speaker-dependent systems are capable of recognizing the voice of a single person, usually adaptive systems that adapt to a particular person. Because one person's voice is significantly different from another, systems based on a single human voice are simpler and much more reliable, as the system “learns” the speaker's tone, emphasis, and volume.

The advantage of speaker-independent systems is that anyone can use them. There is no need for the aforementioned learning or practice, however, such a system is extremely complex and less reliable. These systems work with a lot of pre-created patterns and try to bridge the person dependency by averaging.

According to a following classification of speech recognition systems can be:

- isolated word;
- connected word;
- continuous speech-based systems.

Isolated word systems use words separated by a long time, so they can only be used to give short instructions. In connected word systems the pauses between words are minimal, and even continuous speech is handled by dictation systems.

The classification of systems can be done on the basis of another characteristic, which is already related to the specific task to be solved. Then the type of task, field of expertise, workflow for which the given system is to be used will be decisive. In this case, you need to answer the important questions about the size of the dictionary set and the vocabulary the software works with.

An important consideration is the environment in which they are intended to be used (e.g., how "noisy" it is, what is the speed of speech to be interpreted.) Recognition systems from good quality speech provide the starting point, they need to be made more robust later, so they can be made suitable in environments with higher noise loads. At present, the technology is not yet at the level of recognizing completely free speech with acceptable accuracy, as it would require overly large dictionaries and hardware capable of handling them.

EFFECTIVENESS OF SPEECH RECOGNITION

After all this, let's review some additional issues related to speech recognition, the clarification of which can help the selection and creation of the applicable software.

Effective speech recognition is also a critical part of any voice command system. The most important measure of voice recognition is recognition accuracy. This metric needs to be determined in advance, taking into account the options available, but getting closer and closer to 100%!

In the case of continuous recognition, several methods can be used to measure the efficiency of speech recognition and thus its usability. The most commonly used quantity is WER (Word Error Rate), for which we look at its short description. The recognition result, if it was not in that form before, is converted into a series of words. We compare it to the reference transcript using the dynamic programming method, where we assign the following weights to each option:

- C (correct recognition): 0
- S (substitution): 10

- D (deletion): 7
- I (insertion): 7

The evaluation will be based on the lowest total weight binding. Using the above letters to indicate the number of specific phenomena, the following recognition metrics can be defined:

Correct Rate:"Corr"= $\frac{N-S-D}{N}X100\%$

Accuary:"Acc"= $\frac{N-S-D-I}{N}X100\%$

No. 1. illustration: Defining a recognition metric

where N is the number of all recognition units (words) in the reference transcript. In most applications, it is also a mistake to insert words that are not in the reference, this only appears in the recognition accuracy. Recognition accuracy can be negative if the number of insertions is large.

The generally accepted definition of recognition error is as follows:

Error Rate: "ER"= 100% - "Acc" = 100% - $\frac{N-S-D-I}{N}X100\%$

No. 2. illustration: Definition of recognition error (Source in the bibliography.)

WER: For word recognition units, therefore, the recognition error is WER. However, in the case of the Hungarian language, the word recognition error can in some cases give an overly pessimistic estimate of the accuracy of recognition.

LER: LER (Letter Error Rate) is common, which uses “letter” recognition error as a metric. (The space is also defined as a letter value, otherwise it is calculated in the same way per character unit as the word error rate.)

In practice, however, it is not usually the absolute value of the recognition error that is at issue, but most often its change. Within this, too, the relative degree of improvement is typically the subject of interest. This is defined below for both WER and LER.

$$\text{Relative improvement } (-\Delta ER_{rel}) = \frac{\text{ERreference-ERnew}}{\text{ERreference}} \text{X}100\%$$

No. 3. illustration: The relative value of improvement (Source in the bibliography.)

Finally, from a practical point of view, the development of the time required for recognition can be a very important metric, of course in the case of given hardware. The RTF (Real Time Factor) is the usual measure for this. (So lower values are better.)

$$\text{RTF} = \frac{\textit{time spent on recognition}}{\textit{length of recognized speech}}$$

No. 4. illustration: Real Time Factor(Source in the bibliography.)

From the fact that we obtained better results in one recognition test than in the other, we cannot yet state with 100% certainty, the latter approach is generally better, since we can only work with a finite-sized test set. In addition to the relative reduction in recognition error and similar metrics, it may be useful to provide a significance level. This shows the probability of error in classifying one approach as better based on the results.

For example, with a 2-sample Z-test based on recognition rates, we can obtain a probability estimate of how well we can be sure that we have made a good decision by judging one of two different recognition approaches tested under the same conditions as the other.

The weakness of the procedure is that it only gives a well-founded estimate if the recognized words are independent of each other or if Z, as defined above, is indeed close to the normal distribution. While in isolated word tests this is the case for sufficiently large numbers of samples with a word error rate, when recognizing continuous speech, it is less so with respect to the word and letter error rate (since linguistic and pronunciation modeling assumes that consecutive units are not independent of each other).

Because of these problems, more complex methods than the above are often used, mainly to test the significance of continuous speech recognition results. An example is the non-parametric Wilcoxon signed rank test in the NIST (National Institute of Standards and Technology) recommendation. The method is suitable for estimating the reliability that B is better than A based on the results of A and B recognition systems running on the same test data compared on segment pairs.

speech style - especially if the speaker has a unique pronunciation or strong accent. During military use, this can be a particular difficulty, especially during multiethnic exercises. That finding is especially true for computer-based voice recognition, and like similar applications, this fact should (can) be used to increase the accuracy of voice recognition. In the pre-prepared documentation (instructions), a specific person can be appointed for the transmission of the data (by creating reserves, of course), who will be given the task of transmitting the data. A person can easily understand a speech where the individual words come together, there is no audible separation between them that would divide it into words or sentences. While listening to the speech, we are not only able to understand each word, but we can also distinguish each word from each other.

Words that need to be handled by a speech recognition system need to be translated and put into a dictionary. People have a large vocabulary, so we are able to recognize thousands of words. Consequently, speech recognition systems capable of entering text into a computer must also have a dictionary of thousands of words. These systems are called large dictionary systems. (Large dictionary systems are also known as loose dictionary systems.) Large dictionary (loose dictionary) systems contain 20-80,000 words, so in some languages they can already be considered a virtually dictation system (STT: Speech to Text). However, the Hungarian language is an agglutinative language, so the inclusion of a given word in the dictionary cannot mean the inclusion of all forms of the word. Compared to the English language, we can say that an English language system with a dictionary of 25,000 words already works with acceptable quality, while a Hungarian language system with the same number of words cannot work with sufficient efficiency. At the other extreme of speech recognition system solutions are systems designed for the user to answer yes or no to the questions asked, these are small dictionary systems. Small dictionary systems are also called bound dictionary systems, which work with only about 100 words. For military missions, the use of English is acceptable, so the 25,000 words mentioned may be enough, but profession-specific terms should be considered. Small dictionary systems can also be used, as short commands "fit" into the 100-word frame.

SPEECH RECOGNITION METHODS

In the following, we will look at the methods we can use to perform the various speech recognition tasks.

There are basically three components to speech recognition:

- feature extraction: we try to highlight elements from the changes in the sound wave that have little intraindividual and interindividual characteristic (regardless of who said what emotional state);
- pattern matching: the same word cannot be pronounced twice in the same rhythm, so the task of pattern matching is to eliminate differences between pronunciations with different rhythms and spectral characters;
- post-processing: the use of post-processing is no longer typical today. Preprocessing (e.g., noise reduction) makes recognition more robust.

During the highlighting, the time function is divided into frames (windows), which are 10-30 ms long windows, and the windows are placed on top of each other in 50% coverage. The shape of the window can be of two types: Rectangular or Hamming window.

If the time function of speech is f (t) and the time function of the window is w (t), then the windowed function is (t) = f (t) ·w (t). The Fourier transform is very good for spectral characterization. Since samples are usually available in advance, DFT (discrete Fourier transform) is used. The DFT gives the samples of the stacked spectrum (the DFT of a series of numbers gives sufficient samples of the spectrum belonging to the series of numbers).

$$A(\omega) = F(\omega) * W(\omega) = F(\alpha) W(\omega - \alpha) d\alpha$$

No. 5. illustration: Fourier transform(Source in the bibliography.)

Next, let's take a look at the basic concepts of pattern matching. They gave e.g. isolated words (with highlighted vector sequences), prototypes or phonemes (these also include vector sequences), ie vector sequences representing the linguistic unit on which the recognition is based. The task is to be able to determine from the so-called test pronunciation which reference it most closely resembles. The biggest problem is that people are able to pronounce the same word in different rhythms, but the same is true for a person pronouncing the same word twice. So we need to find the technique by which the right things will be put together.

There are three methods for this, two of which are based on statistical observation, the third is based on a template.

- HMM - Hidden Markov Model (statistician);
- ANN - Artificial Neural Network (statistician);

- DTW - Dynamic Time Warping (template based).

In the HMM method, rhythmic changes are taken into account (eg in isolated word speech recognition). The model is forced to step every 10th ms, but is not forced to step from there. Thus, with this technique, fundamental rhythmic differences can be eliminated in principle. It is also possible to have a jumping edge if one of the sounds is not pronounced. Why is this called a hidden Markov model? Because, unlike the usual way for finite automata, we do not know here what state the process is in. This must be inferred from the observation. The model outputs a PT vector while reaching the "N" state in the states. The observation series is denoted by O (as observation). Meanwhile, we cannot determine from the emission (the vectors emitted by the Markov process) which state we are in. A state can have many different vectors, so we prefer probabilities. $P(O_t|q_j)$ is a probability value, where q_j is the jth state and O_t is a continuous set of values. We assign a density function value to each point. This density function must be determined from databases.

The Dynamic Time Warping method is only suitable for simple recognition tasks, so we will not go into the method in detail, although it may be useful if you can only add a new dictionary element by announcing it.

The Artificial Neural Mesh (ANN) is suitable for isolated word speech recognition and nonlinear classification as part of feature extraction, which is a proven but not significant addition to the GMM (Gaussian Mixture Model).

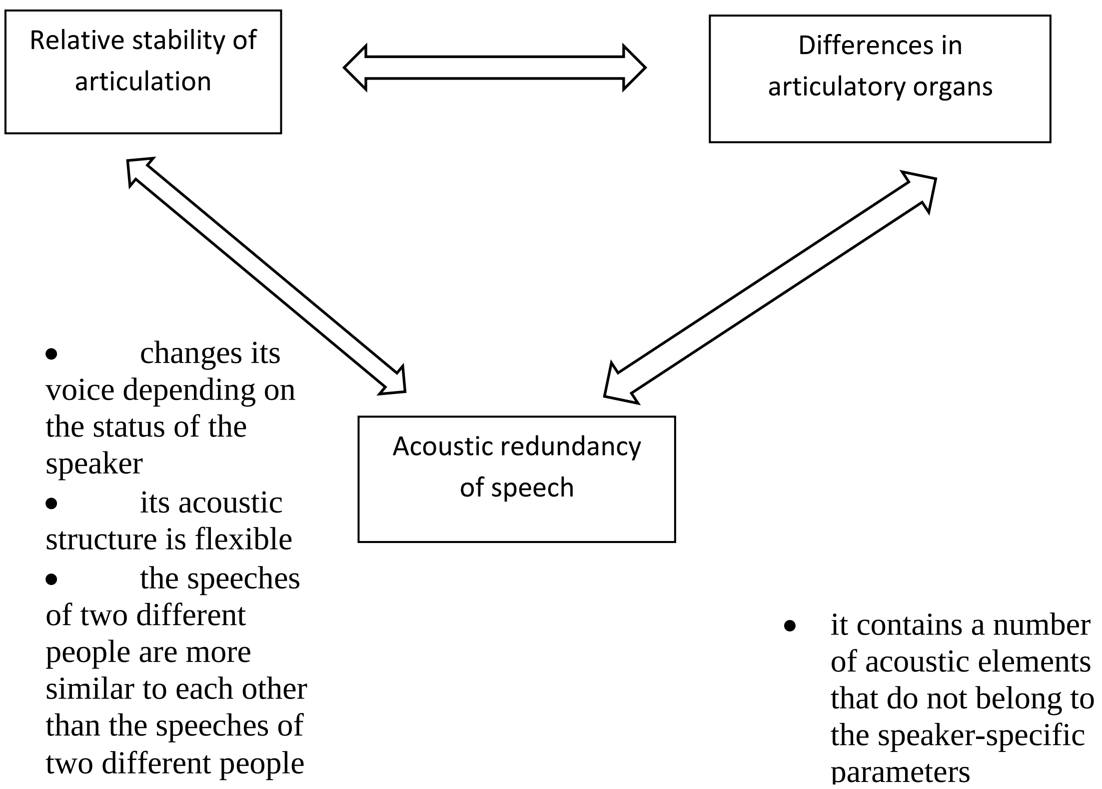
We need to use the next option if we want to use more than just isolated words. The basic idea is to merge the isolated word HMM Markov models so that we bring grammatical information into the system through the model topology. In this case, the statistical approach can be an advantage, which is quite simple, and at the same time proved to be the most effective approach. However, a number of negative phenomena also appear because natural languages cannot be described by deterministic grammar, and the text is not the same as the phonogram, so pronunciation modeling is also required and a size problem can arise. However, in the case of the Hungarian language, it can be an advantage to be able to infer the pronunciation well from the written form.

Speech recognition is also organically linked to speech recognition, the main question of which is whether the person of the speaker can be determined on the basis of the spoken speech, if we know the person or not. (When performing military missions, we are very unlikely to know the speaker!) In the study, the initial assumption is that the neural spectrogram generated in our brain contains the characteristics of the speaker. But whether this information, these parameters are characteristic of the speaker to such an extent as e.g. the fingerprint?

There are basically two directions to speaker recognition:

- whether nx persons can be excluded from option n
- which of the n options is the nx event
- a combination of the two: is it included, and if so, who can it be?

The paradox of speaker recognition can be illustrated by the following figure:



No. 6. illustration: Speech recognition problems (Source: own editing.)

When examining a speaker, a number of other problems must be addressed by any applicable software. Let's look at what these problems may be, just by listing them, and we'll show the relevance of the military application in parentheses behind the lists:

- Speaker identification based on tone of voice (phonetics) (Not relevant!)
- To what extent is a person's voice and speech characteristic? (Not relevant!)
- How to determine the individual tone? (Not relevant!)
- Which speech training configuration do you show the closest connection with? (Not relevant!)

- How can tone be expressed: acoustic-phonetic, perceptual-phonetic or all together? (Not relevant!)
- What subjective impressions should be considered regarding tone of voice? (Not relevant!)
- The place of speech (pragmatics). (Relevant!)
- Semantic structure, meaning (what terms I choose) - strategies. (Pre-regulated!)
- Syntactic structure (in what order, how do I say them) - transformation rules. (Pre-regulated!)
- Phonological rules, phonetic structure. (Not relevant!)
- Articulation functions. (Not relevant!)
- Acoustic waveform. (Not relevant!)
- The single voice of a single speaker can be very diverse under laboratory conditions and neglecting several other factors. (Not relevant!)
- Changes in the pitch of the basal tone: changes with age (feminine slightly deepens until adulthood, but basically does not change, deepens more in old age, feels very deep in adolescence, quite deep in adulthood, and then rises again in older age). (Not relevant!)
- Emotions also affect (joy, sorrow, etc., but these two are best identified) speech. (Not relevant!)
- Prosody is more characteristic than segmental structure: pitch, tempo, intensity, pause structure, rhythm, articulation change. (Not relevant!)
- Environmental conditions are also decisive in changing the pace of speech. (Relevant!)
- if we want to automate speech recognition, changing time relationships can be a problem: the pace of two speech patterns is not the same, whether the speaker was now the same or not, and speech speed can be affected by emotional state and most importantly noise conditions. (Pre-regulated!)
- After many submitted reports, the speech will be monotonous (modulation decreases). (Pre-regulated!)

SUMMARY, CONCLUSIONS

The possibilities of increasing the efficiency of an activity can be increased by managing information extensively. A relatively new element in the field of artificial intelligence studied, the possibility of increasing the efficiency of different types of work, may be the use of speech recognition systems to handle incoming information. In the performance of military missions, the use of a speech recognition system can be a step forward in precisely those areas where recent surveys have shown significant backlogs. In various multinational operations (exercises), the transfer of information based on common principles is a key issue in the cooperation of NATO armies. The practical application of the speech recognition system dates back a very short time and the number of professions in which the conditions of application have been created is still relatively small. In conclusion, the application of artificial intelligence in speech recognition can also mean significant perspectives in the performance of military tasks, thus increasing the efficiency of the performance of tasks. This article therefore undertook to describe the theoretical foundations and, I hope, provided the basis for the analysis of the possibilities for practical implementation, which will be explained in the second part of the article.

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The study of the Hungarian Sport University's football team from the aspect of technical movements.

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Abstract:

There is close contact between The Hungarian Sport University Club (TFSE) and the Sport University (previously the Semmelweis University Sport and Sport Science Faculty (TF)), because the students of the University are provided the opportunity to do sports by the Club. The football section has been in operation for the longest time in the University, which didn't reach as significant successes as it had had before, unfortunately. Therefore started us different tests to bring the reasons on light of the unsuccessful time. We emphasized the technical tests among many others, which also can show us a part of the mistakes. We took account and analyzed later individual and team performances at ranked matches using an analyst sheet made by us. We distributed the technical moves to 5 different categories, which are the good and bad execution of the passes, the tackles-interceptions the shootings and the ball losses. The shootings are valid when the shooting arrives into the goal area (six-yards box) or above it. The results showed us that, based on the technical moves, the team performance fell off, but the outcomes didn't have significant difference, except the shooting. We found more connection and proportions between the team and the individual outer and inner factors, that opened new aspects and made further studies possible.

Keywords:

Introduction

During the study the team were playing in the Budapest 1st league, won the Budapest Cup, received many times medals in the league, and won the Hungarian University League (MEFOB) not one time. Those player who became the member of the team as a freshman mostly came from the youth leagues and just completioned their 18 years. The average age of the team was much closer to a youth team (20 years) than a normal adult team.

That's why more aspects needed to be considered during the training from the youths' side than from the adults' sport1. We are talking about players, who have few adult matches and little experience. In our opinion the student-footballers who attend to the TF become all-round accomplished, that provides them the further development. The bookish and practical teaching during the college years help them to develop, step forward in the individual and team playing. All that involves that the athletes of the TFSE have to take part much more physical actions than other team's players, and then themselves, before they got into the university. This makes the players all-round accomplished, and provides a strong motorical skill foundation. However it's also true that they need to find the way, how can be the training and the studying both efficient2. To sum up, we can say with a little exaggeration, that the structure works similar to the academic way, due to the fact that the collective learning, the mealing and dorm opportunity is also provided under the University.

Method

Based on Dubecz's[3] skill complex, the skill can be distributed to different groups, such as conditional, coordination, emotional-affective and cognitive skills. These skills cannot be strongly divided, due to that they effect each other, different areas' development can influence the other area.

Additionally, the coordination skills are in close connection to the technical skills itself. Different technical developer exercise make influence to other coordination and conditional skills too (the variety of the exercises with the help of space, time, dynamics components changing). In the learning phase we distinguish rough and refined coordination phase, where we can ascertain that the peak of an achievement is when the movement is executed well at stake.

In the followings, the presented match analyzer sheet[4] serves the goal we talked about previously, analyze the execution of the technical[5] skills at matches, at stakes.

We were studying the season I. (2006-2007) and season II. (2007-2008) of the Hungarian Sport University Club, in the aspect of how did the executed technical[6] and tactical[7] moves change.

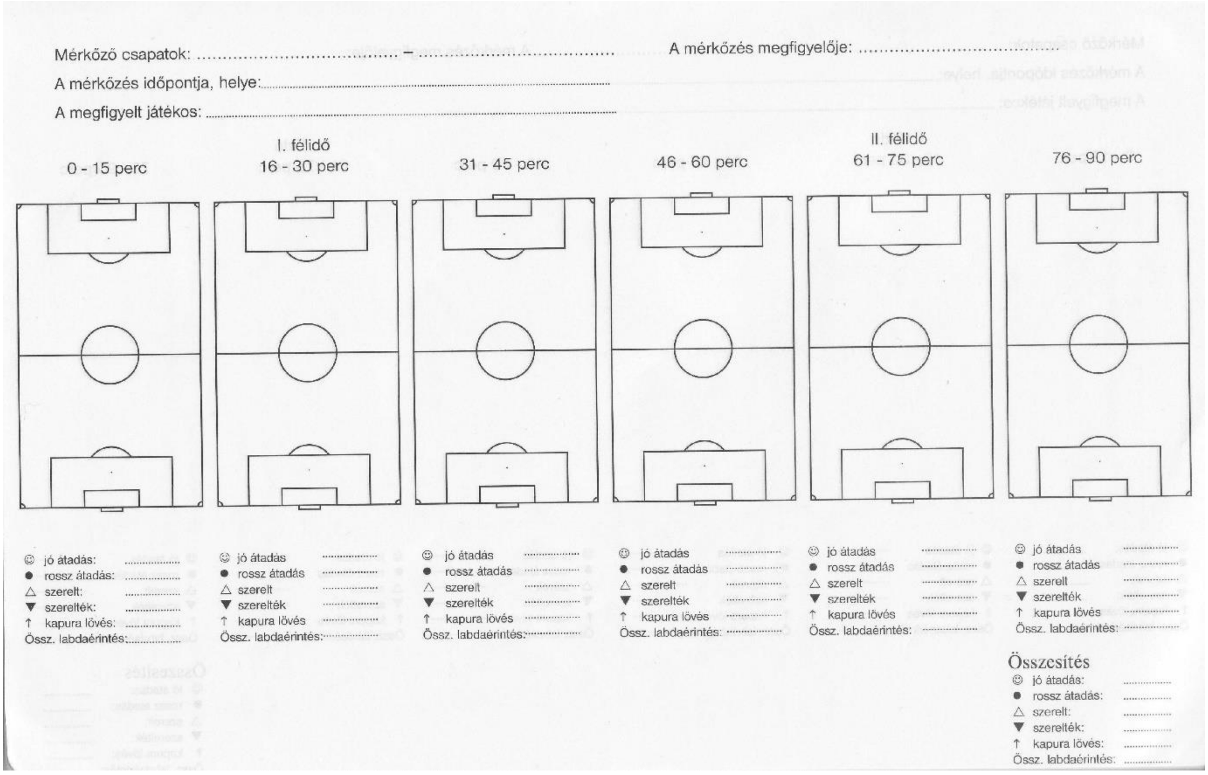

Figure1. Match analyzer sheet

On the header of the sheet we can see the teams and players, moreover there are the match date, where it takes place and the name of the analyzer. Besides the halves, it's also splitted into 15 minutes parts. In these parts we can analyze the players' good (circle) and bad (point) passes, the tackles-interception (white triangle) or the ball losses (black triangle).In addition the shootings' number and the angle is also drawn (arrow), because the help of the symbols, the action is also can be located on the sheet. You can also analyze the performance of the 15 minutes parts, the halves or the full time, so it can be seen to the end, that how many bad or good passes, tackles-interceptions, ball losses or shootings were done.

With these number we can measure the positive changing, development from match to match or from season to season.

It's also worth to mention that the sheet[8] is not only can be used for the technical moves analyzing, but for other tactical factors, such as the set-up of attackings[9].

Our hypothesis: There is a significant difference at the technical moves of The Hungarian Sport University Club team in the course of the 2 years.

In the course of the 2 years 225 sheets were filled, however we need to note the fact that the squad did change through the years, therefore we had to delete the „N"-s, who stopped being the member of the squad in the second year, so the number of the sheets decreased to 209. The results came out by the MO Excel 2003 program's average counting. The statistical counting were done with the same software, used a one-sample t-test, where the significance level is $p<0,05$.

Results

Season average for 2x15 matches played, the summed up technical moves in the season I. is 45.1.

- Good passes: 21,42 .
- Bad passes: 8.3 .
- Tackles-interceptions: 9.46 .
- Ball losses: 3.35 .
- Shootings: 2.57.

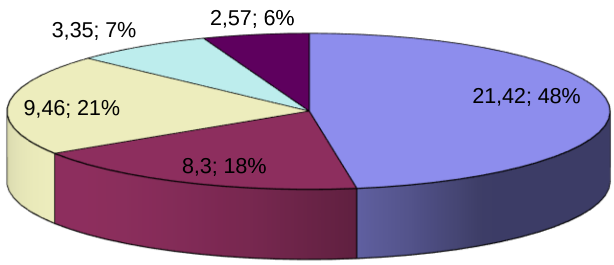

Figure2. The technical moves percentage share in season I.

We can see the good passes, colored blue, make 48% share, 21.42 moves average, and the bad passes, colored bourdon, make 18% share, 8.3 moves average. The yellow painted tackles-interceptions make 21% share, 9.46 moves average, the zian colored ball losses make 7% share, 2.57 average of the full technical repertoire.

In season II., the totalized technical moves decreased to 37.45 average.

- Good passes: 16.08 .
- Bad passes: 8.34 .
- Tackles-interceptions 8.1 .
- Ball losses: 3.53 .
- Shootings: 1.4 .

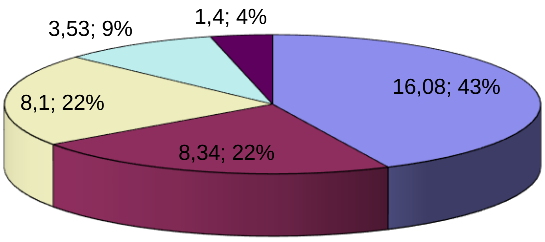

Figure3. The technical moves percentage share in season II.

Discussion

We can read out from the data, that in season II. the team's average results definitely decreased in all category. The good passes based on the blue part decreased by 5%, from 21.42 to 16.08, and the tackles-interception share grew 1 unit, but the number of the moves decreased to 8.1 from 9.46 based on the yellow part. The bourdeu colored bad passes increased 4%, from the number 8.3 to 8.34, but it's surprising that produced only 4% fall in average. The opponents' tackles-interceptions grow 2% in the zian part, from the number 3.35 to 3.53. It is interesting, that the shootings increased in some cases per matches, (purple part), but the totalized and average number fell down with 2%, from the number 2.57 to 1.4. Despite the decreasing, statistically significant difference is just demonstrable at the shooting part, therefore we can declare, that our hypothesis wasn't proved.

Good passes: p=0,052.

Bad passes: p=0,14

Tackles-interceptions: p=0,069

Ball losses: p=0,07

Shootings: p=0,001

Conclusion

Studying the players' team performance experienced we, that the reason of the performance quality-falling were the new signed freshmen[10]. Besides them, the other players developed, correlate to themselves. Hereby build in new players to the team is not an easy task, and even if it's efficient, the progression is in the process. On the other hand, in season II. more injury happened, that also could have negative effect to the team. Unfortunately, we need to count on this factor, due to the fact that in football, injuries are more common than in other contact sports[11], not only by the youths, but by the adults team too. According to our subjective opinion, in the season II. league was stronger than the previous one. We also find correlation between the players' number of lessons and the performance[12]. During the college years, there are more figure subject in the second and third year .They produced a higher proportion of well-performance against those, who didn't have as many as figures.

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