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The relationship of some kinematic projectile variables to the distance lost over the bar and the percentage of their contribution to digital achievement using artificial neural networks in the effectiveness of the high jump

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Abstract

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The objectives of the study were to design a kinematic model using artificial neural networks of the kinematic projectile variables at the distance lost above the bar and according to the classification of the different heights of digital achievement and the percentage of their contribution to digital achievement in the effectiveness of the high jump and the lowest error rate and to predict the values of the most important kinematic projectile variables at the distance lost above the bar and according to the classification of the different heights and the percentage of their contribution to digital achievement in the effectiveness of the high jump. The research hypotheses included the possibility of predicting the values of the most important kinematic projectile variables at the distance lost above the bar and the percentage of their contribution to digital achievement In the effectiveness of the high jump, it is possible to design a model based on the variables of the kinematic projectile, the distance lost above the bar and according to the classification of the different heights and the percentage of their contribution to the digital achievement in the effectiveness of the high jump. With the lowest error rate, the descriptive approach was used in the method of correlational and comparative relationships to solve his problem. The researcher chose the research community, which are the fourth stage students in the Faculty of Physical Education and Sports Sciences – University of Qadisiyah for the academic year (2023-2024), and their number (264) students after excluding the students, where the final number became (187) samples. Then, the research sample was selected in a random way and by lottery method, which was represented by two divisions(D and F) and their number (60) laboratories after performing each sample Three attempts at different heights (1.45 cm, 1.50 cm,1.55cm) where the total number of observations (180) of the sample, the researcher conducted two tests (the first test) to pass the beam (from the beam to the highest height of the center of gravity of the sample body (the missing distance) in the effectiveness of the high jump and the goal of the test(calculating the distance measured from the bottom of the point of the jumping hip to the highest point of the upper edge of the beam) and that the method of performance The sample stands on the start line of the high jump event and performs the technical stages of the event and then passes the beam so that the sample runs in balanced rhythmic steps and then rises and passes the beam and the height of the sample above the beam is calculated (the distance lost above the beam). Each sample is given one attempt at each of the different heights. The distance measured from the bottom of the hip point of the hopper to the highest point of the upper edge of the beam is calculated. (Second test) The beam passes from the ground to the highest height reached by the body above the beam in the high jump event. The goal of the test is to calculate the height of the body of the sample above the beam from the ground to the highest height of the hip point above the beam and the method of performance(standing The sample is on the start line of the high jump event and the sample performs the technical stages.

Definition of research

1-2- Introduction and Importance of Research:

Modern science in our time has witnessed a great and rapid development in various fields of life, where education has received a large share of successes and the accumulation of scientific experiences, and these successes were not the result of chance, as it was the result of correct scientific planning and the use of many different sciences and knowledge, from many research experts and specialists in the field of education in order to find the best ways and means of education in accordance with biomechanical laws and their success to learn and develop various sports skills and events.

Athletics is one of the most widespread games around the world, including jumping, jumping and throwing activities, as sports movements are a form of movement for the human body, including arena and field games competitions, as each of them has its own skill and physical specifications, especially those who practice them if the real goal is to reach the higher levels of the sample.

Biomechanics is one of the modern sciences that have influenced the scientific progress of human motor performance, which has been specific to mathematical movement and motor performance, which has had a great impact on the progress of modern records, as the world records of athletics have developed as a result of the development of science and technology in detecting obstacles to obtaining the best numbers in events and addressing these obstacles in scientific ways. Among the sciences that have helped to develop mathematical achievement in general is biomechanical science (biomechanical). This is what is known (Talha Hussam, 7,1993), as "it is the field in which all the knowledge, information and research methods related to the structural and functional composition of the human motor system are applied." The presence of scientific devices and means used such as devices and diagnostics led to the ease of the function of clarifying the movement of the athlete, regardless of the different possibilities, as it is known that the naked eye of the person is insufficient to obtain accurate scientific information and facts for some mathematical movements. As well as Arafa (Qasim Hussein Hassan, Iman Shaker,1998, 41-42), kinetic analysis is the main tool that researches the art of kinetic performance by studying the parts and components of the movement to reach the smallest details in it, which helps in reaching improvement and development of performance. He also pointed out the mechanism (Issam Abdel Khaliq,1999, 104-105) that gives the trainer and the sample a picture of the typical movement and the minutes of errors, thus choosing the appropriate training means and methods to avoid motor errors and finally saving time and effort for both the trainer and the athlete.

The effectiveness of the high jump is one of the activities of athletics, which has undergone a lot of changes in terms of motor performance and skills, and the development that accompanied these many sudden changes in the jump, which led to the improvement and development of athletic

achievement, which was directly related to the change in the technique of the jump, as well as the way that accompanied this development, taking into account the application of mechanical aspects that are related to the requirements of the motor performance of the high jump, as the nature of motor skills according to their kinematic characteristics is what can determine to a large extent the characteristics of the physical characteristics of the effectiveness. He pointed out (Raysan Khuraibet, Najah Mahdi,1992, 15) (and that judging the validity of the movement by estimating and evaluating it is an inaccurate case in scientific research to understand the minutes of the movement and identify its errors and know the power of upgrading. Therefore, the trend began to rely on the method of kinetic analysis with accurate devices and means through which the minutes of movement can be recorded in the smallest unit of time so that the different amounts of power that adopt the reality of performance can be identified). Dave Anderson (2,92) pointed out that the most prominent techniques of artificial intelligence are artificial neural networks that are designed for many uses, the most important of which is the recognition of people, situations, sound, image, fingerprint, font recognition, handwriting, simulation of systems, and building a future vision (predictive) of any performance. Where learning with the help of artificial neural networks is a guide for the sample, trainers and specialists in the field of sports so that through the use of this model, it can judge the level and technical evaluation and skills of performance by obtaining the results and circulating them to the sample as well as the possibility of returning to this model, which helps in saving time, effort and money. This is one of the resources of the importance of this study. Moreover, evaluating the level of performance as well as providing a programmed model according to the results of statistical analysis is the closest to the mechanical behavior through deepening and entering the worlds of artificial intelligence to overcome some of the obstacles facing researchers and specialists, which can be used in correction processes. In addition, building a future vision (predictive) by achieving and simulating technical performance based on the results of the model to predict the kinematic variables taken from the practical performance of the research sample, as the kinematic aspects with their branches of angles, distances, speed and timing give indicators of all the variables involved in determining the level of achievement, and thus the possibility of detecting the optimal performance and knowing the strengths and weaknesses.

Hence, the importance of the research was manifested in knowing the relationship between some of the kinematic variables and the missing distance through the use of a mathematical kinematic model according to artificial neural networks in the effectiveness of the high jump in order to avoid some of the obstacles facing the sample and provide them to the trainers during the training process by building a future vision of digital achievement and simulating technical performance

based on the results of the model to predict the kinematic variables taken from performance to reach the best mechanical conditions in order to develop achievement.

Research problem:

Through the researcher's observation of the effectiveness of the high jump, he noticed that most of the sample faces a problem while passing over the beam, as the skilled performance during the moment of the arrival of the sample above the beam, in which the jumper is exposed to a set of variables through which we can determine the performance above the beam, as there are variables that can contribute to determining the shape and performance of the jump above the beam, including (the height of the hip point off the ground, the height of the hip above the beam, the speed of the hip over the beam, the length of the last step before ascension, the time of the last step before ascension, The angle of the knee of the rising man at the moment of rising, the average speed of the hip during the rising stage) When performing the traversing over the beam, the sample loses a certain distance above the beam and is called(the missing distance), which leads to failure to achieve the required height, which thus leads to the failure to achieve the required digital achievement, as these missing distances appear during the passage of the sample over the beam and this distance is determined between the height of the hip point of the body of the sample above the beam and the highest height of the beam and the reason for the appearance of this distance is the lack of accurate calculation of the sample at the specified height, which must be close to the beam As well as confusion and tension when performing the sample, which leads to dropping the beam, and when the sample exceeds the distance above the beam to a certain extent, this leads to a lack of economy in the force exerted during the traverse and thus to not benefiting from that missing distance, and from the point of view of the researcher that the reason for this is not to rely on the mechanical foundations of the kinematic variables as well as the absence of biomechanical models for this effectiveness through which the correct performance of angles and points of the body can be applied. Therefore, the researcher intended to conduct this research by imaging and analyzing the previously mentioned kinematic variables using and employing artificial neural networks in the mechanical field, as it is one of the important and worthy topics to study in our mathematical field, as well as the lack of a scientific classification of the sample raises the problem of overlap between the factors affecting it and then the lack of access to accurate specialized information and thus the inability to select well as being the basis for developing the curriculum and diagnosing errors for motor performance, as there will be several specific heights of effectiveness when performing the effectiveness in order to determine the reason for not benefiting from the lost distance above the beam during the passage, which can be used to exceed Subsequent heights and achieving the required digital achievement. The

biomechanical model is one of the most important variables that can be studied for the purpose of determining the skill level of the sample.

Research objectives:

1- Identifying the values of some variables of the kinematic projectile with the missing distance above the beam and the percentage of their contribution to the digital achievement in the effectiveness of the high jump.

2- Identifying the relationship between some of the kinematic projectile variables with the missing distance above the bar in the high jump event.

3- Identifying the percentage of the contribution of some kinematic projectile variables at the missing distance above the beam and according to the classification of the different heights of digital achievement using artificial neural networks in the effectiveness of the high jump.

4- Designing a kinematic model using artificial neural networks of the kinematic projectile variables at the missing distance above the beam and according to the classification of the different heights by digital achievement in the effectiveness of the high jump and with the lowest error rate.

5- Predicting the values of the most important variables of the kinematic projectile with the missing distance above the beam and according to the classification of the different heights in the effectiveness of the high jump.

1.5 Research Hypotheses :

1- There is a significant relationship between the kinematic projectile variables with the missing distance above the beam and the percentage of their contribution to the digital achievement in the effectiveness of the high jump.

2-The possibility of predicting the values of the most important kinematic projectile variables at the missing distance above the bar and the percentage of their contribution to digital achievement in the effectiveness of the high jump.

3-The model of the kinematic projectile variables (the distance lost over the beam) can be designed according to the classification of the different heights and the percentage of their contribution to the digital achievement in the effectiveness of the high jump with the lowest error rate.

Research fields

1-5-1-Human field/ students of the fourth stage in the Faculty of Physical Education and Sports Sciences - University of Qadisiyah.

1-5-2- Spatial field/ playground of the Faculty of Physical Education and Sports Sciences/ University of Qadisiyah.

1-5-3-Temporal scope/ for the period from (13/1/2023) to (10/5/2024)

3- Research Methodology and Field Procedures :

The researcher used the descriptive method of correlational and comparative relationships to solve the problem of his research. The term "method" refers to "the methods, procedures or approach used in research to collect data and reach results, interpretations, explanations or predictions related to the research topic" (Yousef Al-Enazi, 1999, 4)

Research populationand sample:

When conducting any research, the researcher must make the correct and accurate selection of his research sample, by collecting data from the entire indigenous community, or from a sample that represents the community. (Luxury sane,1979, 136)

The researcher selected the research community, which are the students of the fourth stage in the Faculty of Physical Education and Sports Sciences – University of Qadisiyah for the academic year (2023-2024), and their number(264) male and female students, and after excluding the female students, the final number became (187) students. After that, the research sample was selected in a random and lottery manner, which consisted of two divisions(D and F) and their number was (60) samples, and after each student performed one attempt at each of the different heights (1.45 cm, 1.50 cm,1.55cm), where the total number of observations reached (180) views of the sample, and the sample was 100% of the research community, they were homogenized in variables (total length – weight – length of the trunk – height of the man).

Table (1) represents the specifications of the research sample

Variables	UoM	Arithmetical mean (Maths.)	Standard deviation (Maths.)	Modulus of torsion = torsion modulus (Mech.)	Coefficient of variation	Lower value 97	Highest value
Trunk	,	57.02	455	.018	306	54.00	60.00
tread	,	93.35	1	563	1.822	91	95.00
Length overall	,	178	2484	0-411	.699	177	180.00
Weight	kg	346	2523	0.373	0.860 **	66.00	69

3-3- Tools, means and devices used in the research:

3-3-1-Scientific research tools:

- A. Arabic Sources and References
- Personal interviews
- Tests and measurements used in the research.
- Observational and analytical skills
- Internet

3-3-2-Means and devices used in the research:

The researcher used the tools through which he can collect data, namely:

- Fast Casio cameras with frequency (300 images/second) number (2) carried by a tripod.
- Measuring tapes to identify points of places.
- Auxiliary staff.
- Type A4 papers to record the names of students and their physical measurements.
- Weight measuring device and length measuring tape.
- HIGH JUMP
- Kenova is used for kinetic analysis.
- Laptop (hp) with high precision specifications.

3-4- Tests used in the research:

3-4-1-The first test/passing the beam (from the beam to the highest height of the center of gravity of the sample body (the lost distance) in the high jump event:

- Objective of the test: Calculate the distance measured from the bottom of the hopper hip point to the highest point of the upper edge of the crossbar.
- Tools used: The high jump device is divided into (beam, legs, mat).
- Method of performance: The sample stands on the starting line of the high jump event and the sample performs the technical stages of the event and then passes the beam so that the sample runs in balanced rhythmic steps and then rises and passes the beam and calculates the height passed by the sample above the beam (the lost distance above the beam).
- Scientific conditions: Each sample is given one attempt at each of the different heights.
- Recording method: The distance measured from the bottom of the hopper hip point to the top point of the upper edge of the crossbar (the distance lost above the crossbar) is calculated.

3-4-1-The second test/passing the beam (from the ground to the highest height reached by the body above the beam) in the high jump event:

- **The aim of the test: Calculate the height of the sample body above the beam, and measure from the ground to the highest height of the hip point of the body above the beam.**
- **The tools used: the high jump device and it is divided into (beam, legs, rug)?**
- **Method of performance: The sample stands on the starting line of the high jump event and the sample performs the technical stages of the event and then passes the beam so that the sample runs in balanced rhythmic steps and then rises and passes the beam and calculates the height passed by the sample above the beam.**
- **Scientific conditions: Each sample is given one attempt at each of the different heights.**
- **Recording method: The height of the body is calculated from the ground to the top of the hip point of the body above the beam.**

3-5-The exploratory experiment:

The researcher conducted the exploratory experiment on (13/2/2024) at 8:30 am on a group of five sample at the Arena and Arena Games Stadium in the Faculty of Physical Education and Sports Sciences at the University of Qadisiyah. The experiment was carried out by performing the test for the effectiveness of the high jump, where the most appropriate distance was determined to suit the method of photography and to identify the most important obstacles facing the research to be avoided in the main experiment and determine the locations of the cameras as well as coordination with the assistant work team and qualifying the necessary supplies when conducting the main experiment. Among the points:

1-The extent of readiness of the test takers when conducting the test.

2-Checking the required number of assistant staff.

3-Identifying the most important errors that appeared in the exploratory experiment to address them in the main experiment.

4- Determining the most important kinematic variables required in the main experiment.

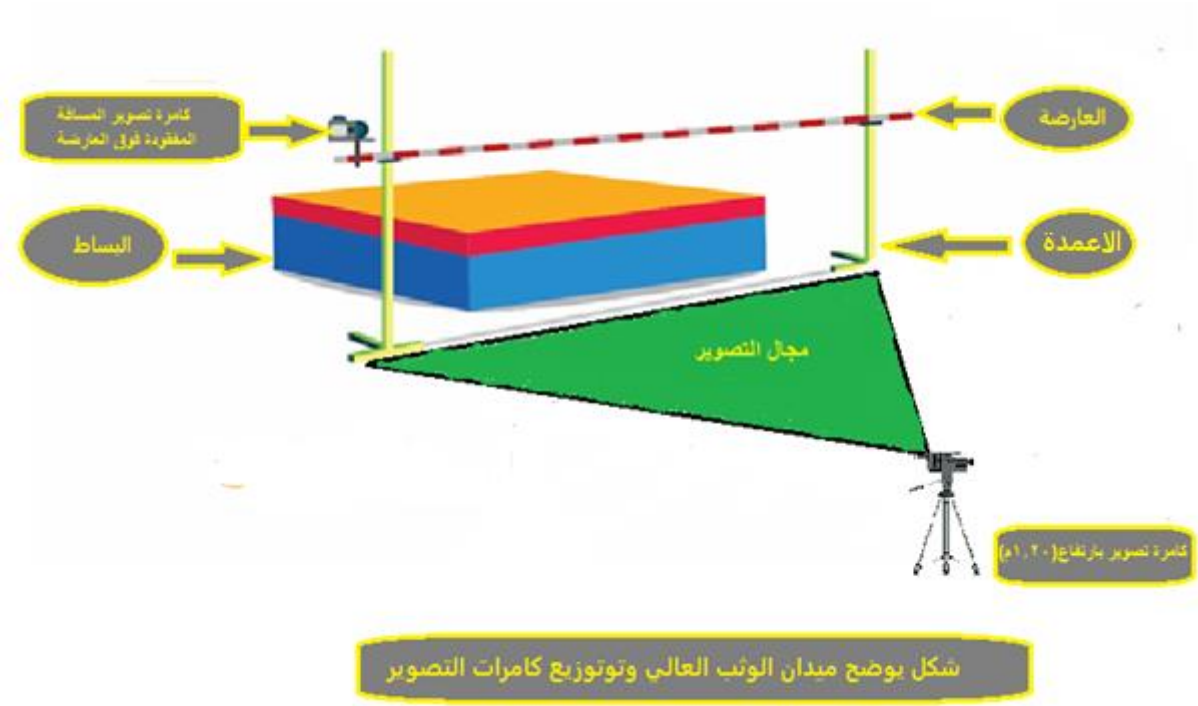
5- Through the exploratory experiment, the best distance for filming was reached.

6-The height of the cameras(1.20m).

7. Ensure the suitability of the test for the research sample.

8. Ensure that the time taken to conduct the test is known and applied.

9- Distance of the camera from the throwing circle (8 meters)



شكل يوضح ميدان الوثب العالي وتوتوزيع كامرات التصوير

3-5-1-Field procedures for the reconnaissance experiment:

1- Extraction of kinematic variables.

2- Each sample is given only one attempt at each of the different heights and all these attempts are subject to imaging and analysis.

3-The sample starts from the start line of the event and the distance measured from the bottom of the jumping hip point to the highest point of the upper edge of the beam is measured as well as its final achievement from the ground to the highest height above the beam in the high jump.

4- Gives a negative rest between each attempt.

3-6- Description of kinematic variables:

By reviewing the previous literature from sources, references, postgraduate studies and personal interviews, as well as specialists in the field of biomechanics and specialists in the field of yard and field, the researcher reached the most important kinematic variables in the effectiveness of high jump.

1-The length of the step of getting up before ascending: It is the last step of the approaching run and is measured from the moment the foot pushes the ground to the moment the foot contacts the ground for the jumper and is measured in meters.

Figure No. (1) shows the length of the step

2-The angle of the knee of the ascension man at the moment of contact: It is the angle between the thigh and the leg of the ascension man at the moment of contact with the ground. As shown in Figure (2):

Figure (2) shows the angle of the ascension man's knee

3-The angle of the elevation man's knee at the moment of its maximum flexion: It is the angle between the thigh and leg lines at the moment of its maximum flexion and as shown in Figure (3):

Figure (3) The angle of the ascension man's knee

4- Average hip velocity during the upward stage: Displacement is the straight line extending from the hip point at the moment of contact to the hip point before leaving with the horizontal line and is measured(meters) and as shown in Figure (4).

Figure No. (4) Average hip velocity

5- Rise angle: It is the angle between the fulcrum of the metatarsal, the center of gravity of the body, and the horizontal line of the ground, as shown in Figure (5).

Figure (5) Rising angle

6- Maximum hip height before the ascending man leaves the ground: It is the distance of the hip height from the ground and as shown in Figure (6)

Figure (6) Maximum hip height

7-The angle of flight: It is the angle between the horizontal line passing from the center of the earth and the straight line represented by the path of the center of gravity of the body at two points in the flight and as shown in Figure (7).

Figure No. (7) Aviation angle

8- Hip height from the moment the beam passes (distance lost above the beam): The distance measured from the bottom of the point of the hopper's hip to the top point of the top edge of the beam and measured in(cm).

9-The height of the hip from the ground after the ascending man leaves the ground: It is the distance measured from the bottom of the hopper's hip point to the ground and measured in meters. Participation in UNITAR training programmes

Figure No. (8) shows after the man left the ground

10- Achievement: It is the legal achievement measured from the ground to the upper edge of the beam.

3-7-The main experience:

The researcher conducted the main experiment on (21/2/2024) and at (8.30) at the time of the lecture at the Athletics Stadium at the Faculty of Physical Education and Sports Sciences at the University of Qadisiyah, where the researcher placed cameras in the locations identified in the experiment for reconnaissance and marked with significant

points, and then the test was conducted on the selected sample of (60) individuals, where each laboratory was given one attempt at each of the following heights (1.45m, 150m ,1.55m) so that the number of attempts With a total of (180) attempts or observations, then each laboratory was photographed during the implementation of the performance using the beginning of the high jump at the heights mentioned above. The kinematic variables and the missing distance above the beam were calculated as well as the final achievement from the ground to the highest height reached by the body above the beam for each sample using the programs of the analysis program (Kenova) to measure the different angles. The design of the artificial neural network model was also used to know the test and training ratios and the contribution percentage of the variables and prediction. One signal was given to the auxiliary staff to operate the imaging cameras before the sample began to perform the attempt and as Described below:

1- Camera No. (1) /The sample is visualized from the front and each of the following variables is extracted from it (the length of the rise step, the time of the rise step, the angle of the man's knee weighted by the moment of contact for the ascension foot, the angle of the man's knee weighted by the moment of contact, the angle of the man's knee weighted by the moment of its maximum bend, the angle of the rise, the maximum height of the hip before leaving the man of ascension, the angle of flight).

2- Camera No. (2) / Visualize the sample from the side at a certain angle according to the performance and the hip height is extracted from the moment the beam passes (the missing distance), the final completion). The table shows gold price in Dubai in Dirhams (AED) per gram, and 10 tolas bar, for the most commonly used carats in Dubai which are 24 carat, 22 carat, and 18 carat. Also 21 carat is sometimes used.

Table (2) shows the distribution of kinematic variables on cameras No. (2.1)

#	Kinematic variables	UoM	Notes
1	Length of the step of getting up before ascending	meter	Camera No. (1)
2	The angle of the ascending man at the moment of contact with the ground	Score	Camera No. (1)
3	Ascension leg knee angle Moment of maximum flexion	Score	Camera No. (1)
4	The speed of the hip during the stage of rising (from the moment the man touches the ground even before leaving it	33m/s	Camera No. (1)
5	Rise Angle	Score	Camera No. (1)
6	Maximum hip height before the ascending man leaves the floor	meter	Camera No. (1)
7	Flying Angle	Score	Camera No. (2)
8	Hip Point Height at Girder Crossing (Missing Distance)	meter	Camera No. (2)

9	Hip height off the ground	meter	Camera No. (2)
10	Achievement	meter	Camera No. (2)

7- Statistical means: The researcher used the statistical bag (spss), of which the following were found:

- Arithmetical mean (Maths.)
- Standard deviation (Maths.)
- Winding
- Correlation coefficient (Maths.)
- Kurtosis
- Coefficient of variation
- Contribution percentage, standard error.

Part IV

4-Presentation, analysis and discussion of the results:

4-1-Presenting the results of the kinematic projectile variables at the missing distance above the beam and the percentage of their contribution to digital achievement using artificial neural networks in the effectiveness of the high jump, analyzing and discussing them:

4-1-1- Presentation of the results of the values of the description of the variables of the kinematic projectile with the distance lost above the beam and the percentage of its contribution to the digital achievement using artificial neural networks in the effectiveness of the high jump

Statistical Parameters / Kinematic variables	Lower value 97	Highest value	Arithmetical mean (Maths.)	Standard Error	Standard deviation (Maths.)	median	Coefficient of variation	Kurtosis	W
Angle of Rise before Ascension	1.10	1.56	1.35	0.01	0.08	1.35	5.91	1.39	-
The angle of the ascending man at	130	157.24	.142	0.49	6.62	144	4.64	-0.74	

the moment of contact with the ground									
Knee angle Ascension man Max flexion moment Ascension man	125	157.57	144	0.58	7.69	145	5.34	- 47 -	-
Average hip velocity during the recovery phase	3.11	8.12	5.06	0.08	1.12	5.12	22.21	-0.13	
Rise Angle	80.23	96.12	88	0.36	4.84	87	5.50	- 1:40.	
Maximum hip height before the ascending man leaves the floor	1.00	1.26	1.17	0.00	0.04	1.17	3.84	3.94	
Flying Angle	40-21	58.11	85	0.36	4.82	89	9.86	-1.02	
Hip Point Height at Girder Crossing (Missing Distance)	0.03	0.11	0.06	0.00	0.02	0.07	32.21	-0.78	-
Hip height off the ground	1.31	1.49	1.38	0.00	0.04	1.37	3.23	0.28	
Achievement	1.25	1.33	1.29	0.00	0.03	1.28	2.57	-1.51	

Table (3) shows the descriptive values of the kinematic projectile variables and the missing distance over the beam in the high jump event

The **idea of this research is based on a constructive scientific basis that none of the values can be dealt with for any of the statistical coefficients of inference unless there is a complete scientific description in terms of the nature of the measures of central tendency, dispersion and natural distribution, as well as homogeneity, that is, the full description of the form of the kinematic variables, through which we obtain verification of the subsequent practical hypotheses in terms of choosing the appropriate statistical coefficients. The researcher resorted to the statistical description of the values of those variables achieved by the students of the Faculty of Physical Education and Sports Sciences (fourth stage) in all attempts, which amounted to (180) attempts. Through Table No. (3) of the extracted data for the attempts that were applied by the sample to the values of the kinematic projectile variables with the distance lost above the beam and the percentage of their contribution to digital achievement using artificial neural networks in the effectiveness of the high jump by obtaining the results (standard deviations, computational media, coefficient of difference, torsion, torsion errors, the highest value and the lowest value, and kurtness), which represent the nature of the performance of the sample through which the distributions of the studied kinematic variables can be described, the distance lost above the beam, and the percentage of their contribution to digital achievement. One of the measures of central tendency, which is the computational mean of the description of the values related to the kinematic variables, which expresses their values with only one value, was used to identify the accuracy of the computational mean in expressing the values of the variables. The research resorted to one of the measure of dispersion, which is**

(standard deviation), the purpose of sensing the prevalence of the values around the computational mean, through which the value of the standard deviation is compared to the computational mean. The (Authorship and Translation Committee,2007, 16-17) pointed out that (if the mean represents the data well, most of the data will accumulate close to the mean, and therefore the value of the standard deviation is small compared to the value of the mean) and through this, the values of the standard deviation are considered acceptable when they are not more than a quarter of the value of the arithmetic mean (the first quarter). From the above table, it was found that the standard deviation values of all kinematic variables were small compared to the value of the arithmetic mean, and therefore the mean is considered an accurate value for the real values, that is, the attempts that were taken from the sample have achieved the values of the variables, and they are close, and this indicates the proper selection of the arithmetic mean as a model for the attempts that were applied. The table shows that the torsion values were high for some variables such as the height of the hip from the ground, where the highest positive torsion was (0.89), followed by the achievement variable with a value of (0.89), while the torsion value was followed by the hip speed rate variable during the advancement stage with a value of (0.20), for the flight angle variable (0.10), followed by the angle of advancement (0.09)), followed by the elevation man's knee angle variable for the moment of maximum flexion (0.03). As for the rest of the values of the variables that appeared, their values were negative among them. (Groeneveld, R. A, 1984,391) The Kurtosis Scale expresses the degree of data accumulation for its medium or more precisely its frequency in the distribution range. The more repeated the values close to the value of the medium, the more positive the kurtosis value becomes and vice versa. When the values far from the value of the medium are repeated, the kurtosis becomes negative. The table shows that the value of the maximum hip height variable before the man left the ground reached the highest kurtosis with a value of (3.94), followed by the other variables whose values are positive and in order. Thus, for the values that are negative, the lowest kurtosis value of the hip speed rate variable during the stage of advancement was (-0.13). This indicates that it did not exceed the value of (±1), which means that they are pointed values excluded from the medium. This is indicated by the value of the above coefficient of difference for this variable and the rest of the kinematic variables. One measure of dispersion (the coefficient of difference) was used to compare the dispersion of kinematic variables with each other, (Abdi, H., 2010, 169) (as the

coefficient of difference measures the heterogeneity of the values of the variables independently of the unit of measurement used for them, as the coefficient of difference eliminates the unit of measurement by dividing the standard deviations by the value of the arithmetic mean). The values of the coefficient of variation for the variables studied by the researcher varied, if the highest value of variation for the variable (hip height from the moment the beam passes (missing distance) was (32.20), while the smallest value was (2.57) the coefficient of variation for the achievement variable.

4-1-2-Presenting the results of the correlations of the matrix (calculated values) for the values of the kinematic projectile variables with the missing distance over the beam and the percentage of their contribution to the digital achievement in the effectiveness of the high jump.

Table (4) shows the correlation matrix for the kinematic projectile variables values and the missing distance over the beam

~~Variables~~	Length of the step of getting up before ascending	The angle of the ascending man at the moment of contact with the ground	Ascension leg knee angle Moment of maximum flexion	Average hip velocity during the recovery phase	Rise Angle	Maximum hip height before the ascending man leaves the floor	Flying Angle	Hip height from the moment the crossbar passes (missing distance)	Hip height off the ground
Length of the step of getting up before ascending	1								
The angle of the ascending man at the moment of contact with the ground	0.163	1							
scension leg knee angle Moment of maximum flexion	069	0.115	1						
Average hip velocity ring the recovery phase	0.001	274	-0.056	1					
Rise Angle	325	269 .	323	219	1				
Maximum hip height fore the ascending man leaves the floor	082	257 .	0.093	.076	0.128	1			
Flying Angle	0.139	303	(0.068)	345	272	0.034	1		
p Point Height at Girder Crossing (Missing Distance)	0.086	134	314	0.174	309	.142	0.133	1	
ip height off the ground	211	0,099	226	$ 200	448	0.087	235	295	1
Achievement	385	0.162	314	-0.074	0 .482**	.066	0.167	211	365

* Significant value at a significance level of 0.05
* * The value is significant at the significance level of 0.01

Table (4) above shows the existence of the significant correlation relationship between some variables among them on the one hand and between them and the dependent variable (effectiveness) on the other hand, where the matrix shows us the simple correlation relations in which the calculated correlation values vary between the moral significance and the non-significant significance in both positive and negative directions according to the rule of deciphering the number , and that the rise of any of the values calculated for the correlation above than the tabular value, and this indicates the existence of a significant correlation relationship, where its direction is determined positively or negatively and according to the reference to the values, as the values are distributed between the moral significance and the non-material significance, if the moral values, which are either direct or inverse relations.

Where the above table No. (4) shows the results of the matrix the correlations between the values of the kinematic variables and their characteristics when performing the effectiveness of the high jump affecting the digital achievement, where the researcher believes that the emergence in some correlations between the kinematic variables that have been studied in the performance of the high jump is due to the skill requirements when performing the kinematic duty during performance, which as one of the determinants of performance, which must take into account the mechanical characteristics of the effectiveness, in addition to the existence of accurate neuromuscular compatibility of the parts of the movement, in addition to the use of mechanical law that helps to perform the ideal of effectiveness in accordance with the correct mechanical conditions of mathematical kinematic performance, as the values of the kinematic variables that have been studied have affected the mathematical level at the jump, as well as one of them has affected the other. If it appears from the above table that the value of the correlation coefficient of the kinematic variables was variable due to the change in the mechanical conditions of a sample during the performance of different heights, where the values of the advancement step length variable appeared before ascending with the achievement variable with a significant correlation coefficient of (.385 * *0), while the correlation coefficient of the elevation knee angle variable was the moment of maximum flexion with the achievement variable with a significant correlation coefficient of (.314 * * 0) at the level of significance (0.01) as well as the same variable of the elevation knee angle with the moment of maximum flexion with the hip point height variable at the moment of traversing the beam (lost distance) also with a significant correlation coefficient of (0.314 * *) at the level of significance (0.01),

while the advancement angle variable there is a significant value with the achievement variable with a correlation of (.482 * *0), there is a significant correlation between the hip height of the land variable at the level of achievement variable (0.01).

When discussing the variables with moral values and the reason for their emergence is that the elevation at the hopper, where it blends the horizontal vehicle (the approach stage), which is characterized by its physical capacity and the transitional speed of the vertical vehicle (ascension), that is, the explosive force to ascend at an angle ranging between (80-85) degrees, through which the highest vertical distance is reached, which is the main goal of the effectiveness of the heights(cm1.45 – cm1.50 - cm1.55). Also, the hopper at this stage pushes the ground with maximum force and in the least possible time, the physical characteristic of ascension is (explosive force), and he pointed out(Akram Hussein Al-Janabi,2016, 107-1111), so the sample must pay attention to this stage from all directions and put the entire ascension foot on the ground and push it starting from the heel and finally the comb of the foot.Also, the arrival of the hip at this stage is the most difficult part when crossing the beam, where the jumper pulls the palate to the chest and tries to raise the hip above the beam and after passing the jumper's hip, he raises the knees high by bending the hip joint slightly and then tries to raise the legs high to be tried successfully. The hip height variable from the ground was significant, and the reason is that the physical characteristic of the lack of approach is the transitional speed for the body to move from one place to another. When analyzing this effectiveness, we find that the approach (the transitional speed represents the horizontal vehicle that had to be invested in the achievement, while the angle variable of the ascending man at the moment of contact with the ground showed a random value in the three heights. The reason is that this variable did not have a clear effect because the jumpers (the testers) were unable to reach the highest point before passing the width, and also the value of the maximum height of the hip before leaving the ascending man was random because the force was not affecting the jump during the last step before ascension.

4-2-The steps of building the artificial neural network of the kinematic projectile variables with the missing distance above the beam and the percentage of their contribution to the digital achievement using neural networks in the effectiveness of the high jump.

After the data has been added, which are (9) variables, they have been added to the Bias), which is the coefficient that works to move the intersection line of the slope line with the y-axis, as it represents flexibility in moving it in a way that does not interfere negatively in showing the best slope line. This coefficient is associated with the layer of introducing independent variables and hidden layers. It enters the calculation equation and is treated as any other trainable variable, and its value is always (+1) as a variable, and it affects the subsequent variables that follow it, and these variables do not affect it, and the dependent variable (effectiveness) is made the final result and introduced into the construction of the neural network, in which there are two hidden layers that improve the process of training on the data under study.

Table No. (6) shows the percentages of totals, error and information used in the network

Percentage	Number	SAMPLES.
%70.4	127	Training set
29/6	53	Test group
100%	180	Total number

Sum of Squares	Erfc
0.0%	Training Error Rate
1/9	Test Error Percentage
9	esIndependent Variabl
Standardized	Method of Re-measuring Independent Variables
2	Number of hidden layers
9	Number of First Layer Hidden Units
9	Number of Second Layer Hidden Units
Hyperbolic tangent	Activation function for independent variables
Effectiveness	Dependent variable
Standardized	Method of Re-measuring the Dependent Variable
Logistics	Activation function for dependent variable

It is clear from Table (6) above that the sample was divided into two groups (training and testing), that the training data (70.4%), and the test data (29.6%), as the idea of training for data is slowly adjusted in the values of weights and biases to reach the lowest error value, which leads to improving the work of the artificial neural network, the point was determined to save the optimal weight parameters obtained in the training group, and then another separate data set was used to test our machine learning algorithm, which is the test data set. The data

was used to obtain the ideal weights during the forward and backward payment of network information and in the presence of two hidden layers. The activation function (Hyperbolic tangent) was used as an activation function to calculate the value of (z)extracted for each independent variable after multiplying it by the value of the default weight that was assumed for the function to extract the first layer. It is multiplied by another default weight to be passed to the second hidden layer with the same activation function and then entered with another activation function, which is the function (Identity) to calculate the dependent variable (Effectiveness). Then, the result extracted by the activation functions is compared with the real result and in the case of mismatch Between the estimated function and the real result, the assumed weights are adjusted according to the activation functions mentioned in the mechanism of going back to the first weight that falls between the first independent variable and the first cell of the first hidden layer and calculating again using modified weights and so on until the threshold is reached with which you can not improve the weight equation, as this matter obtains all the independent variables and all the cells of the two layers up to the dependent variable through rotations with an indefinite number until the least error percentage is reached, which is calculated by the (Sum of squares) function. It is clear from the above table that the training process has ended with an error rate of (0.0%), which qualifies the network to implement it on the test sample, which is (53) where the network obtained an error rate for the test of (1.9%), and this percentage is considered very excellent according to the criteria for accepting networks after training.

4-2-2-Presentation, analysis and discussion of the neural network

structure of the kinematic projectile variables and the missing distance over the bar:

After identifying the shape of the (9) variables, which were introduced to build the artificial neural network, the researcher built an integrated neural network (Fully connected neural network), which means that all inputs are multiplied by their weights.

4-2-3-Number of layers:

The structure of the network consists of three completely linked layers, of which two are hidden layers, each of which contains (9) units, while the third layer contains (3) units represented by the dependent variable (efficiency), in addition to the input layer, which contains (10) units and represented by independent variables, as shown in the table below:

Table (7) shows the layering of the neural network

Layers Type	Output shape	Coefficient
1st Layer (Hidden)	9	90

Second layer	**9**	**90**
Layer 3 (Hidden)	**3**	**30**
Total Parameters		**180**
Trainable Parameters		**180**
Teachers not trainable		**0**

The above table No. (7) shows the layering of the neural network in terms of type and form of output for each layer in addition to the coefficient. All layers were of the type of (hidden layers). The hidden layers are the least common in neural networks, as they consist of neurons (units) interconnected in the hidden layer. (Harrison Kinsley, 2020, 11-12) pointed out that the idea is that all neurons of a certain layer are connected to each neuron of the next layer, and this means that their output becomes an input value for the following neurons. This network addressed the training problems that occur when the depth of the network increases. As for the shape of the output, the first and second hidden layers consisted of (9) units of each unit representing an input. The values of the variables in the main layer are multiplied by (10) variables in the values of the weights assumed by the algorithm. After that, the values are modified during training to reach the optimal values. This includes the (Bias), so there are (190) parameter (parameter) for each of the two hidden layers. The third layer (outputs), which consists of (3) units such as the dependent variable (effectiveness), was multiplied by the number of main variables. The total parameters that can be trained are (180) , and the non-training parameters are (zero), meaning that there are no non-training parameters.

4-2-4-The final shape of the net:

After identifying the shape of the variables and dividing the sample into totals, and then preparing the layers and completing all the requirements for building the network of training and testing, in addition to the activation functions and optimization algorithms have become in their final

shows the number of independent variables, amounting to (10) variables with a coefficient of bias (bias), which is equivalent to the value of (bo) in the regression equation, where it enters the calculation equation. It is treated as any other variable and has an intervention coefficient value in all calculations, which affects subsequent variables. These variables do not affect it, as shown by the lines in blue, which is the engine for the intersection point of the regression slope line with the y-axis (Shifting). It is also noted that there are two hidden layers and(3) variables. As for the lead lines, each of which represents the point of weight (weight)or which is called the value of the coefficient that connects the relationship between all cells and its value is confined between (+1), where the value increases above one sometimes to show high

weight weights for each variable equivalent to its relative importance and the percentage of its contribution to the subsequent variable. The first hidden layer has (10) cells as well as the value of the bias coefficient (bias) , each of which is calculated by multiplying the value of the input (x) by the value of the random weight. The result is then entered into an equation called the activation function, as the hyperbolic (tangent) function is used, to reach ideal weights and the lowest percentage of error, and thus the values of each of the hidden layer cells appear, which are the input values in the second hidden layer, which in turn in the same way to show the values of each cell, which are also the input values of the third layer (Outputs) and is symbolized by (z), and the same method continues, but the result that appears is entered in the activation function (identity), and from here the values of the outputs are predicted and the real values are taken from the sample results, to then extract the difference between them using the value of delta () and then the network makes a backward (Backward) through the use of the delta values of the outputs to extract the delta values of the two hidden layers and thus use all the delta value used to extract a new weight (W new) through an equation that uses the new delta (^{new}) with the old weight (W^{new}) to extract the new weight:

Thus, the process continues until the degree of stability is reached, which does not change the unweighted value so that the network is ready to work.

4-2-5-Extracting weights:

After completing the construction of the network, three groups of weights were extracted represented by the first layer (inputs) and the first and second hidden layers, which are as follows:

4-2-6- Weights between the input layer and the first hidden layer:

Table (8) shows the weights between the input layer and the first hidden layer

H.1	H.1	H.1	H.1	H.1	H.1	H.1	H1/2	Trunk H.1: 1	Hidden layer
-0.25	-0.31	(-1.30)	0.92	0.18	-1.43	-0.43	29.0	0.27	(Bias)
0.27	0.30	- 47 -	0.52	-0.15	0.62	0.31	-0.51	0.42	Length of the step of getting up before ascending
-0.24	0.22	29.0	0.12	0.61	0.39	0.01	0.34	-0.56	Ascension leg knee angle Moment of maximum flexion
-0.08	-0.22	-0.37	-0.11	0.86	0.26	-0.30	0.28	0.36	Average hip velocity during the recovery phase
0.27	-0.09	0.34	0.36	-0.26	0.72	0-20	-0.09	0.47	Rise Angle
-0.01	-0.08	0.02	0.03	0.38	0.16	0.16	0.42	-0.56	Maximum hip height before the ascending man leaves the

									floor
0.76	-0.28	- 47 -	-0.19	0.18	0.28	0.15	-0.63	0.72	Flying Angle
0.45	-0.26	-0.67	0.39	-0.41	0.68	0.20	62	0.63	Hip Point Height at Girder Crossing (Missing Distance)
-0.06	0.23	-0.04	-0.51	0.13	-48-	-0.19	0.36	-0.01	Hip height off the ground
0.50	-0.65	-0.43	0.55	-0.09	0.74	0.38	0.36	0.12	Achievement

Table (8) shows the weights for each of the cells of the main input layer, which are represented by the values of the independent variables, which were expressed in the network with the symbol (x), and these weights were obtained through the following equation: x.w + b = a

This means that each of these weights is the product of (x) the independent variable multiplied by (w) the random weight generated by the grid (weight) plus (b) the bias coefficient of the bias layer, where the value of the result is then entered in the hyperbolic tangent function to show the value according to this equation, which is the value of (x) for each cell of the hidden layer, and the total for each of these cells represents (a), that is, the input value for each of the cells of the first hidden layer, and thus the process is continued successively for all cells.

4-2-7 - Balances between the first hidden layer and the second hidden layer:

Table (9) shows the weights between the first hidden layer and the second hidden layer

(H-2)	(H-2)	(H-2)	Trunk H.2: 6	(H-2)	(H-2)	(H-2)	(H-2)	(H-2)	Hidden layer
178	0.392	0.273	090	.597**	0.506	143	.530	—0.088	(Bias)
292	0.322	.228	-0.100	945	882	669	0.202	—0.021	Trunk H.1: 1
069	0-411	0.129	0,099	462	0.727	071	.451	-071	H1/2
360	-221	401	.290	296	337	0.322	352	(0.057)	H.1
0.162	0.378	347	-132.	0.458	1.189	0.056*	416	-0.521	H.1
0.330	.389	0.424	386	561	0.302	-0.233	.451	-0.233	H.1
509	165	0.180	0,099	208	0.169	264	.054	0.128	H.1
474	-.296	0.194	-146	1.026	—0.007	342	.389	-0.188	H.1
410.	– 0.097	.233	0.221	0.354	.118	225	.597**	(0.057)	H.1
.152	265	0.245	.336	-529	865	336	.033	120	H.1

Table No. (9) shows the weights for each of the cells of the first hidden layer, which were represented by the values calculated from the main layer (input), which were expressed

in the network with the symbol (a), where these weights were obtained through the following formula: a.w + b = z

This means that each of these weights is the product of multiplying (a) the values calculated from the main input layer by (w) the random weight generated by the network (weight) plus (b) the bias coefficient of the bias layer, after which the value of the result is then entered into the (hyperbolic tangent) function, and the total for each of these cells represents(z), that is, the input value for each of the cells of the second hidden layer, and so the process continues successively for all cells from (a1 to a10).

8-3-4- Weights between the second hidden layer and the dependent variable layer:

Table (10) shows the weights between the second hidden layer and the dependent variable layer and according to the different heights

Hidden layer	1.45 H	Height 1.50	Height 1.55
(Bias)	0.384	0.019	0.363
(H-2)	185	469	-0.051
(H-2)	.118	164	0.426
(H-2)	312	0.193	0.137
(H-2)	0.090	.753	760
(H-2)	.771	712	0,099
Trunk H.2: 6	110	181	0,022
(H-2)	0,047	0.129	0.258
(H-2)	0.235	-0.350	0.131
(H-2)	-.075	163	185

Table (10) above shows the weights for each of the cells of the second hidden layer, which were represented by the calculated values of the first hidden layer z.w+b = y, which z and these weights were obtained through the following equation:

This means that each of these weights is the result of multiplying (z) the calculated values of the second hidden layer by (w) the random weight generated by the grid (weight) plus (b) the bias coefficient of the bias layer, and then the value of the result is entered in the (identity) function and the sum of each of these cells represents the expected dependent values (y), after which it is compared with the real result.

4-3-9-The final equation of the kinematic projectile variables with the distance lost above the beam and the percentage of their contribution to the digital achievement using artificial neural networks in the effectiveness of the high jump.

4-3-10-Presenting, analyzing and discussing the results of the contribution ratios of the kinematic projectile variables and the missing distance over the bar using artificial neural networks:

Table No. (11) shows the contribution ratios (importance) for independent variables

Contribution Percentage	Shareholder Significance	Variables
99 At 9.	176	Length of the step of getting up before ascending
20%	.037	Ascension leg knee angle Moment of maximum flexion
= 30.	.054	Average hip velocity during the recovery phase
74.8%	0.132	Rise Angle
33	059	Maximum hip height before the ascending man leaves the floor
100%	176	Flying Angle
91	0.161	Hip Point Height at Girder Crossing (Missing Distance)
35	,063	Hip height off the ground
2 .	0.143	Achievement

Table No. (11) above shows the percentages of the independent variables contributing to the dependent variable (effectiveness), which are (10) variables included in the network, where the variables (flight angle, angle of rise before ascension, hip height from the moment of crossing the beam (distance lost), achievement, angle of rise) were achieved respectively in terms of the largest relative importance value, while the lowest value was for the variables (hip height from the ground, maximum hip height before leaving the ground ascension man, average hip speed during the ascension stage, angle of the knee of the ascension man at the moment of maximum flexion) respectively in terms of the lowest value, it is noted that the values of the variables vary between them and we see it clearly in Figure (5).

Figure (4) shows the importance of the variables according to the non-standard value, which are ten variables representing each of (the length of the step of getting up before ascension, the angle of the knee of the man of ascension, the moment of maximum flexion, the rate of hip speed during the stage of getting up, the angle of getting up, the maximum height of the hip before leaving the ground, the angle of flight, the height of the hip from the moment of crossing the beam (distance lost), the height of the hip from the ground, and achievement). respectively in terms of the highest value of importance and this can be explained as follows:

The jumper's body is ejected at the ascension stage, that is, when the sample body arrives above the beam, that is, it is subject to the ballistic law, that is, the flight path of the center of the sample mass will be determined at the ascension stage.

Whereas, the increase in the two variables of the angle of rise before ascension, which contributed by(99.9%), as well as the variable of the angle of rise, which contributed by (74.8%), which means that this angle has a great impact when the sample tries to perform the ascension stage by the distant man, as the larger this angle, which made the sample cross the beam smoothly and flexibly, thus directing the projectile to the highest possible height above the beam and thus achieving the digital achievement. (Nazar Al-Sina,1976, 144) indicates that the extent of our knowledge of the horizontal distance is determined by the amount of the angle of rise and the level of height reached by the body, so the greater the horizontal distance means the decrease in the vertical distance achieved by that body . As for the height of the hip from the moment the beam passes (missing distance), which contributed by(91.2%), which is a high consideration in terms of its impact, as this distance is one of the important things that the sample must take into account while crossing over the beam because the increase in the height of the projectile over the beam significantly leads to the loss of this distance and therefore does not benefit from it, while we see that the flight angle variable has achieved a very high contribution percentage, which is the highest among the variables that have appeared. The reason for this is that this variable is very important when the body becomes projectile over the beam because the goal of effectiveness is to reach the maximum vertical height to pass the beam, which is closely linked to the horizontal vehicle, which represents the speed of approach that a sample can convert to vertical height. This is consistent with mechanical logic and thus achieve the required achievement, as the values of relative importance are considered as evidence for those interested in the high jump and the possibility of benefiting from each variable that contributed to the digital achievement (i.e. the dependent variable), so we must take into account those values when we want to approach the sample.

4-3-9- Testing the suitability of the model:

One of the most important assumptions in any statistical process is the suitability of the sample for the required statistical process, where the assumptions are divided into different statements, some of which are based on the ratio of the sample to the number of tests, some of which depend on the percentage of error and the size of the community, and some of which are collected in one equation, as this is evident in neural networks, as the most important factor in their success is the large number of observations(samples), but in the case of the lack of samples in the current study, it is possible to address it in several aspects.

.5.1 CONCLUSIONS

In light of the results that emerged through the analysis of the research variables, the researcher concluded the following:

1-The results of the analysis showed that there is a direct impact of the variables in the elevation stage in the effectiveness of the high jump.

2- There is a difference in the kinematic variables at the different heights that have been applied.

3- It was found that the values of the hip velocity rate during the advancement stage of most jumpers were weak, which appeared to be an important influence on digital achievement.

4- Both the angle of flight and the angle of rise before ascension affect the appearance of missing distances above the beam ranging from (3 cm _ 11 cm) at various heights(cm1.45, cm150, cm1.55) that were studied.

5-The results showed that there are variables that contributed in different proportions to the digital achievement, which are sequential according to the importance of the agency effectiveness (the angle of flight, the angle of rise before ascension, the height of the hip point at the moment of crossing the beam (distance lost), the angle of rise, the height of the hip from the ground, the maximum height of the hip before leaving the man of ascension, the average speed of the hip during the stage of ascension, the angle of the knee of the man of ascension for the maximum moment). These variables constitute a total of 100%.

6-The results showed a difference in the values of the correlational relations of the variables between the significant and the non-significant and their impact on the variables related to the kinematic projectile variables and the missing distance above the beam.

7- Preparing an internal reference through which the dependent variable can be calculated by standardizing the measurements of all kinematic variables and thus finding an output for them in the kinematic projectile variables and the missing distance over the beam.

8-The results showed that two sample models were built for the kinematic projectile variables at the missing distance above the beam using neural networks technology with almost no probability of classifying individuals.

9-The highest direct effect for the kinematic projectile variables and the missing distance over the beam was recorded in the flight angle variable through the results that appeared.

10- Through the results, the variables (the angle of flight, the angle of rise and the length of the step of rise before ascension and the height of the hip point at the moment of crossing the beam (missing distance) are considered one of the most important kinematic variables affecting digital achievement.

In light of the researcher's findings, he recommends the following:

1-The need to emphasize in the training the development of kinematic variables that have achieved the highest percentage of contribution to digital achievement.

2-It is possible to invest the mechanical variables that have a great impact on the achievement of the failed attempts and harness them in the development of the supposed achievement in the successful attempts.

3- Work as hard as possible to adjust the height of the hip point at the moment of crossing the beam (missing distance).

4- It is possible to train train trainers on the mechanism of technical performance through kinetic compatibility and following the scientific mechanical foundations that affect the digital achievement of the effectiveness of the high jump.

5- Artificial neural networks can be used as an ideal method and model for predicting the sample level between the kinematic projectile variables and the missing distance over the beam.

6-The proposed mechanism can be relied on for the kinematic projectile variables and the missing distance over the beam.

7- Through the results, the researcher recommends using artificial neural networks to design models for the rest of the arena and field events.

8- Work as hard as possible to adjust the approach, especially (the last step before ascension).

9- Adopting the proposed application as it represents a scientific mechanism to determine the level of the kinematic projectile variables and the missing distance over the beam.

10- Adopting the results of the research and developing training curricula to overcome weakness in the physical and skill aspects of the jumpers.

11- Using periodic kinetic analysis to follow up the development of kinematic variables to enhance strengths and work to overcome weaknesses in performance that are accurately revealed by kinetic analysis.

12- Emphasis on man-pushing training to increase the vertical thrust of jumpers during the upgrading phase to address the great weakness at this stage.

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