https://doi.org/10.1051/e3sconf/202346004015

Application of artificial intelligence to preserve the reindeer population in the arctic regions of the planet (case study of the republic of Sakha (Yakutia))

Svetlana Shvetsova[1]

[1]Moscow Polytechnic University, Bolshaya Semyonovskaya Street, 107023 Moscow, Russia

Abstract. This article examines the approaches and prospects for the use of artificial intelligence to preserve the reindeer population in the Arctic regions of the planet (on the example of the Republic of Sakha (Yakutia)). Preserving the fauna of the Arctic regions based on the use of modern technologies, including artificial intelligence, is one of the promising solutions for environmental problems in the Arctic. The study examines the prospects for the use of artificial intelligence in terms of analyzing changes in reindeer migration routes. More accurate and prompt data on reindeer migration routes will contribute to improving the quality of decisions made in the field of reindeer population conservation. The results obtained may be of interest to software developers for analyzing changes in reindeer migration routes. The results of the study on the use of artificial intelligence to preserve the reindeer population can also be used in the development of environmental programs aimed at preserving the reindeer population in the Arctic regions, and in research in this area.

1 Introduction

The fauna and flora of the northern regions have changed significantly over the past century, including the decline of the reindeer population. Preserving the fauna of the Arctic regions based on the use of modern technologies, including artificial intelligence, is one of the promising solutions for environmental problems in the Arctic. In this paper, the prospects for the use of artificial intelligence in terms of analyzing changes in the migration routes of reindeer were chosen as a research area. The analysis was carried out on the example of using artificial intelligence to analyze changes in the migration routes of reindeer. More accurate and prompt data on reindeer migration routes can improve the quality of decision-making in the field of reindeer population conservation.

2 Materials and Methods

In order to collect data aimed at studying the prospects for the introduction of artificial intelligence for the purpose of preserving the reindeer population in the Arctic regions of the planet, a corresponding questionnaire survey was conducted among ten potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes.

The survey was conducted in three different age groups of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes:

• the first group of potential users of software for data analysis on changes in reindeer migration routes – aged 18-30 years;

• the second group of potential users of software for data analysis on changes in reindeer migration routes – aged 31-45 years;

• The third group of potential users of software for analyzing data on changes in reindeer migration routes is aged 46-65 years.

The age breakdown of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes was carried out to take into account the difference in preferences of potential users of software for analyzing data on changes in reindeer migration routes in different age groups.

All surveyed users of the reindeer migration change data analysis software were given questionnaires that included the question: which version of the reindeer migration change data analysis software is preferable for you:

• the first option is with the use of artificial intelligence;

• The second option is traditional software (which does not use artificial intelligence).

For the purposes of collecting and processing data from a survey of potential users of software for analyzing data on changes in reindeer migration routes (depending on the age group), various methods were considered [1-33].

3 Results and Discussion

3.1 Results of a survey of potential users using artificial intelligence to analyze data on changes in reindeer migration routes

3.1.1 *The first group of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes*

The results of the survey of the first group of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes (18-30 years old) are presented in Figure 1.

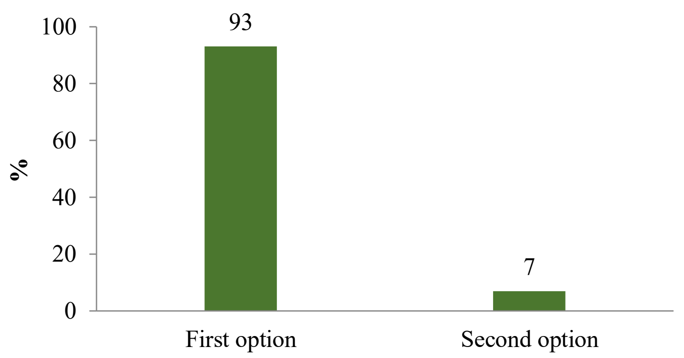

Fig. 1. Results of a survey of the first group of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes (18-30 years old).

3.1.2 The second group of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes

The results of a survey of a second group of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes (31-45 years old) are presented in Figure 2.

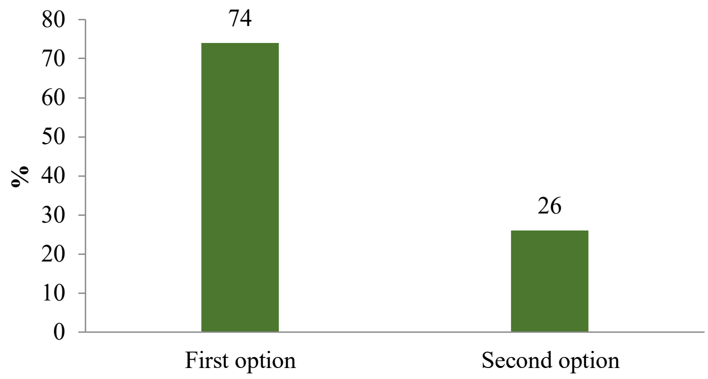

Fig. 2. Results of a survey of the second group of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes (31-45 years old).

3.1.3 The third group of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes

The results of a survey of a third group of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes (46-65 years old) are presented in Figure 3.

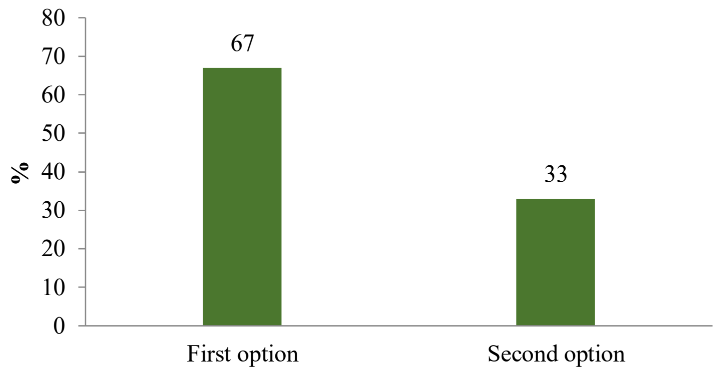

Fig. 3. Results of a survey of a third group of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes (46-65 years old).

The distribution of data in the results of a survey of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes was assessed using the formula [28-30]:

$$r_s = 1 - \frac{6\sum d^2}{n(n^2-1)} \quad (1)$$

3.2 Discussion

The results of surveys of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes (depending on the age group) provide evidence that the use of software to analyze data on changes in reindeer migration routes, has significant potential among potential users, while the preferences of potential users of software for data analysis on changes in reindeer migration routes are unevenly distributed among several age groups (Table 1).

Table 1. Results of surveys of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes (depending on the age group).

Age Groups	Software Type	
	With the use of artificial intelligence	**Traditional software (non-AI)**
First	93	7
Second	74	26
Third	67	33

Figure 4 shows the average quantitative data of a survey of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes (for all age groups).

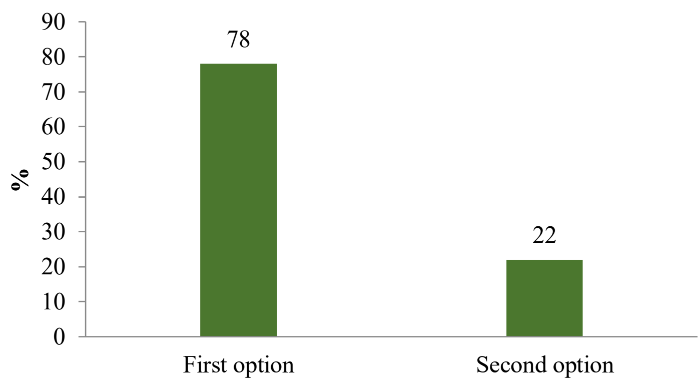

Fig. 4. An average quantitative indicator of survey data from potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes (for all age groups).

From the data obtained (Figure 4), it follows that the average priority value of software for analyzing data on changes in reindeer migration routes is: using artificial intelligence – 78%; Traditional software (not using artificial intelligence) – 22%.

4 Conclusions

This article examines the approaches and prospects for the use of artificial intelligence to preserve the reindeer population in the Arctic regions of the planet (on the example of the Republic of Sakha (Yakutia)). In this paper, the prospects for the use of artificial intelligence in terms of analyzing changes in the migration routes of reindeer were chosen as a research direction. More accurate and prompt data on the migration routes of reindeer can improve the quality of solutions in the field of conservation of the reindeer population. The study presents data on the prospects for the use of artificial intelligence to preserve the reindeer population in the Arctic regions of the planet (on the example of one of the Arctic regions - the Republic of Sakha (Yakutia). An analysis of the preferences of potential users when choosing software for analyzing data on changes in the migration routes of reindeer (depending on the use or non-use of artificial intelligence) was carried out. The data reflect the preferences of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes in three different age groups living in the Republic of Sakha (Yakutia). Place of residence and age of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routesis a data restriction. An analysis of the results of surveys of potential users of software that uses artificial intelligence to analyze data on changes in reindeer migration routes (averaged for all age groups) showed that the average priority value of software for analyzing data on changes in reindeer migration routes is: using artificial intelligence – 78%; Traditional software (not using artificial intelligence) – 22%. The results obtained show the prospects for the development and implementation of specialized software for analyzing data on changes in reindeer migration routes, using artificial intelligence. The results obtained may be of interest to software developers for analyzing data on changes in reindeer migration routes. The results of the study can also be used in the development of environmental programs aimed at preserving the reindeer population in the Arctic regions, and in conducting research in this area.

References

1. S. Mohsan et al., Sensors **23.6,** 2960 (2023) https://doi.org/10.3390/s23062960
2. L. Huafeng et al., Solar Energy **258,** 95–105 (2023) https://doi.org/10.1016/j.solener.2023.04.051
3. M.A. Khan et al., Sensors **23.12,** 5419 (2023) https://doi.org/10.3390/s23125419
4. K. Kumar et al., Sensors **23.10,** 4885 (2023) https://doi.org/10.3390/s23104885
5. R. Myrzashova et al., IEEE Internet of Things Journal **10.16,** 14418–14437 (2023) https://doi.org/10.1109/JIOT.2023.3263598
6. A.V. Shvetsov et al., IEEE Access (2023) https://doi.org/10.1109/ACCESS.2023.3323399
7. S. Srivastava et al., IEEE Access **11,** 17731–17738 (2023) https://doi.org/10.1109/ACCESS.2023.3245041
8. S. Alsamhi et al., Future Generation Computer Systems **148**, 250–265 (2023) https://doi.org/10.1016/j.future.2023.06.001
9. A. Iqbal et al., Future Internet **15.266,** (2023) https://doi.org/10.3390/fi15080266
10. A. Shvetsov, E3S Web of Conferences **402,** 04015 (2023) https://doi.org/10.1051/e3sconf/202340204015
11. A. Shvetsov, E3S Web of Conferences **420,** 04007 (2023) https://doi.org/10.1051/e3sconf/202342004007
12. K. Kumar et al., Fire **6.248,** (2023) https://doi.org/10.3390/fire6070248
13. G.J. Glasser, R.F. Winter, Biometrika **48,** 444–448 (1961)
14. C. Spearman, Am. J. Psychol. **15,** 72–101 (1904)

15. Spearman Rank Correlation Coefficient. In: The Concise Encyclopedia of Statistics. Springer, New York, NY. (2008) https://doi.org/10.1007/978-0-387-32833-1_379
16. A. Shvetsov, S. Shvetsova, V. Gromov, E3S Web of Conferences **371,** 04030 (2023) https://doi.org/10.1051/e3sconf/202337104030
17. Student, Probable Error of a Correlation Coefficient. Biometrika **6(2/3),** 302 (1908) https://doi.org/10.2307/2331474
18. S.H. Alsamhi et al., Advances in Human-Computer Interaction **2023,** 9992393 (2023) https://doi.org/10.1155/2023/9992393
19. H.F. Dingman, Multivariate Behavioral Research **4(4),** 517–522 (1969) https://doi.org/10.1207/s15327906mbr0404_6
20. A. Shvetsov, Aspects of increasing energy efficiency in modern cities based on the transition to a new technological way of life for residents. E3S Web of Conferences, in press
21. E. Zimmermann, Das Experiment in den Sozialwissenschaften [Internet] 245–8 (1972) http://dx.doi.org/10.1007/978-3-322-93057-6_12
22. SPSS Statistics versus SPSS Modeler: Can I Be a Data Miner Using SPSS Statistics? (2017). SPSSreg Statistics for Data Analysis and Visualization, 275–302 https://doi.org/10.1002/9781119183426.ch11
23. SPSS Inc. introduces SPSS/Pro™. Computational Statistics & Data Analysis [Internet]. 1983 Mar; 1:279 Available from: http://dx.doi.org/10.1016/0167-9473(83)90103-2
24. A. Shvetsov, Prospects for reducing energy costs during the transition to a new technological structure in modern urban homes. E3S Web of Conferences, in press
25. W.W.C. Gieskes, C. Veth, A. Woehrmann, M. Graefe, EOS. Transactions, American Geophysical Union **68(9),** 123 (1987) https://doi:10.1029/EO068i009p00123-01
26. S. Mohsan et al., Sensors **23.6,** 2946 (2023) https://doi.org/10.3390/s23062946
27. T. Berman, P.D. Walline, A/ Schneller, Limnology and Oceanography **30(2),** 447-448 (1985)
28. R.C. Smith, K.S. Baker, Applied optics **20(2),** 177-184 (1981) https://doi:10.1364/AO.20.000177
29. A. Shvetsov et al., Transportation Research Procedia **68,** 579–584 (2023) https://doi.org/10.1016/j.trpro.2023.02.079
30. A. Shvetsov et al., Transportation Research Procedia **68,** 573–578 (2023) https://doi.org/10.1016/j.trpro.2023.02.078
31. Spearman Rank Correlation Coefficient. (n.d.). SpringerReference. https://doi.org/10.1007/springerreference_221490
32. T.W. Cochran, R.L. Kabel, R.P. Danner, AIChE Journal **31(2),** 268–277 (1985) https://doi.org/10.1002/aic.690310214
33. W.G. Cochran, Journal of the Royal Statistical Society **100(1),** 69 (1937) https://doi.org/10.2307/2980283