Making Precision Livestock Farming More Energy Efficient Using Compression Algorithms

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Team

Alejandro
Mc Ewen

Felipe
Henao

Simón
Marín

Mauricio
Toro

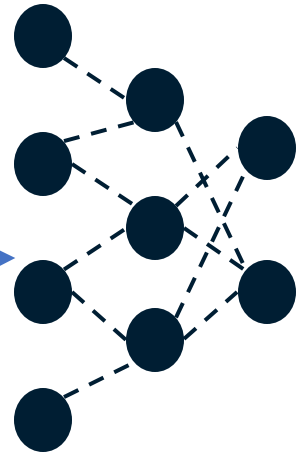
Training Process

Sick-Cattle Images

Healthy-Cattle Images

Convolutional Neural Network

Classification Algorithm



Classification Model

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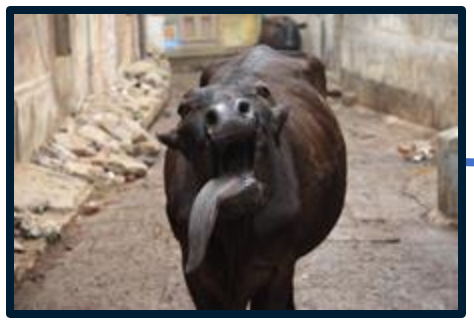
Testing Process



Cattle Image

NN or LZ77

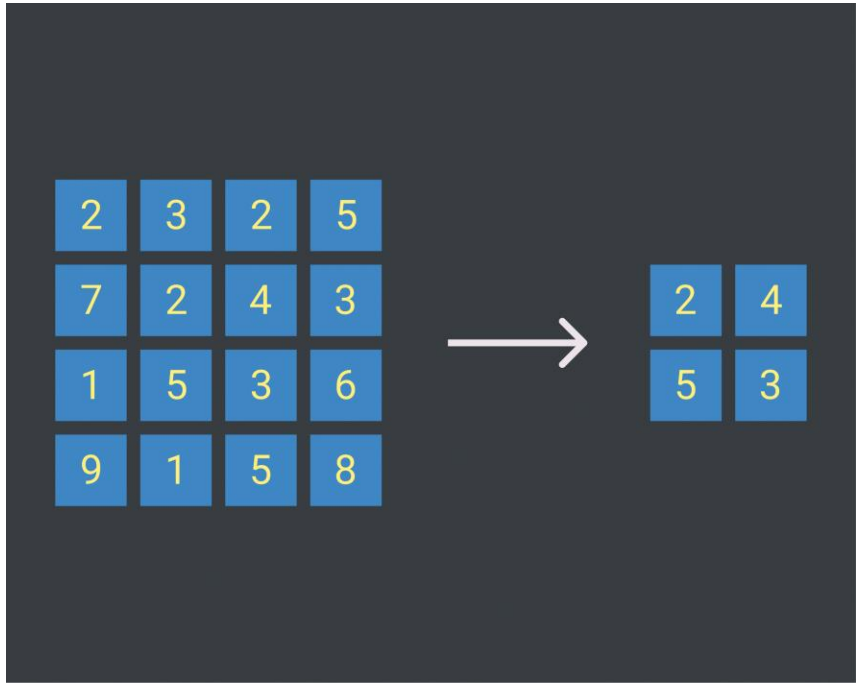
Nearest Neighbor Compression or LZ77 Algorithm

Classification Model

Is sick

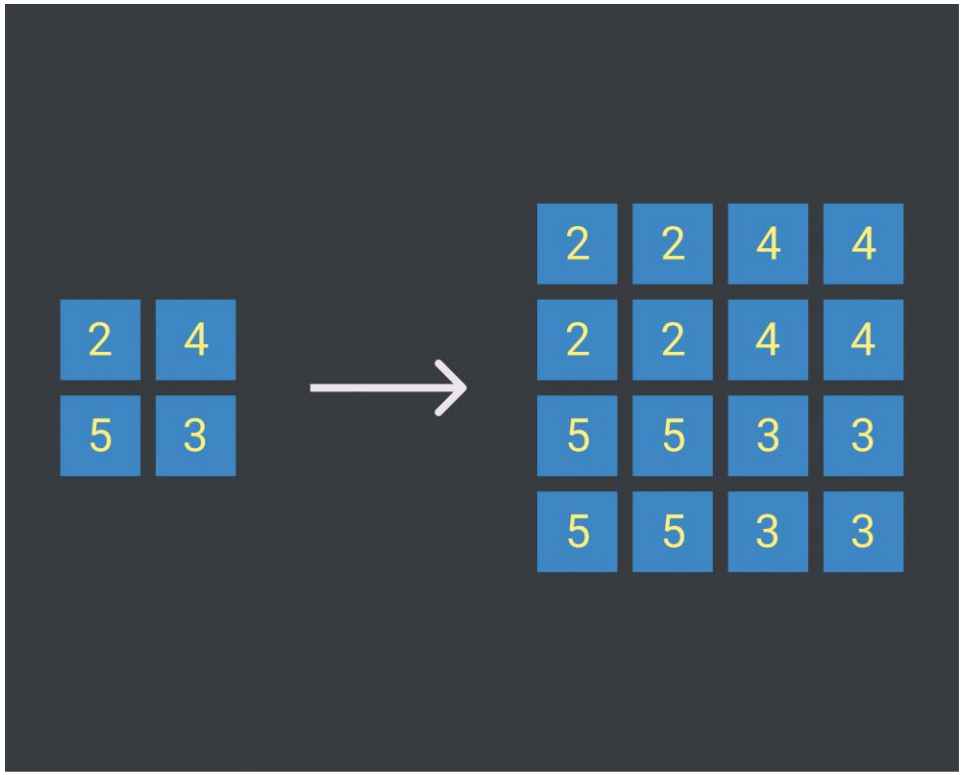
Output

Lossy Compression Algorithm Design



Nearest Neighbor compression gets the most representative pixels of an image and puts them into a compressed image.

Lossy Compression Algorithm Design



Nearest Neighbor decompression takes the pixels and copies them into the higher resolution image.

Lossy Compression Algorithm Complexity

	Time Complexity	Memory Complexity
Image compression	O(N)	O(N)
Image decompression	O(N)	O(N)

Time and Memory Complexity of the Nearest Neighbor image-compression and image-decompression algorithms. N is the size of the original image.

Lossless Compression Algorithm Design

ABCABC

A		
B		
C		
C	3	2

LZ77 grabs the text and puts it into a compressed code.

Lossless Compression Algorithm Design

A		
B		
C		
C	3	2

ABCABC

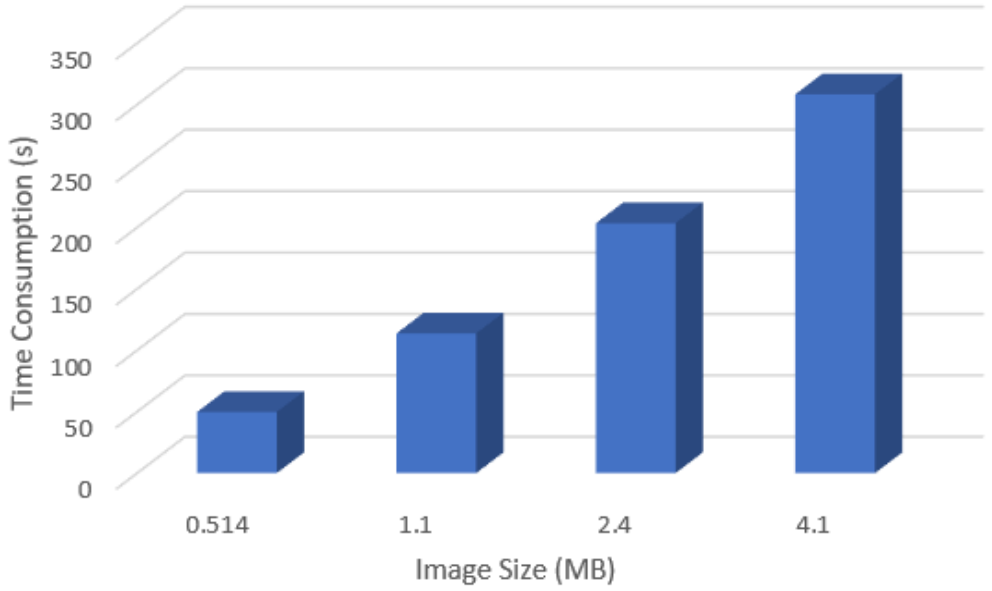
LZ77 grabs the code and decompresses it into the original text.

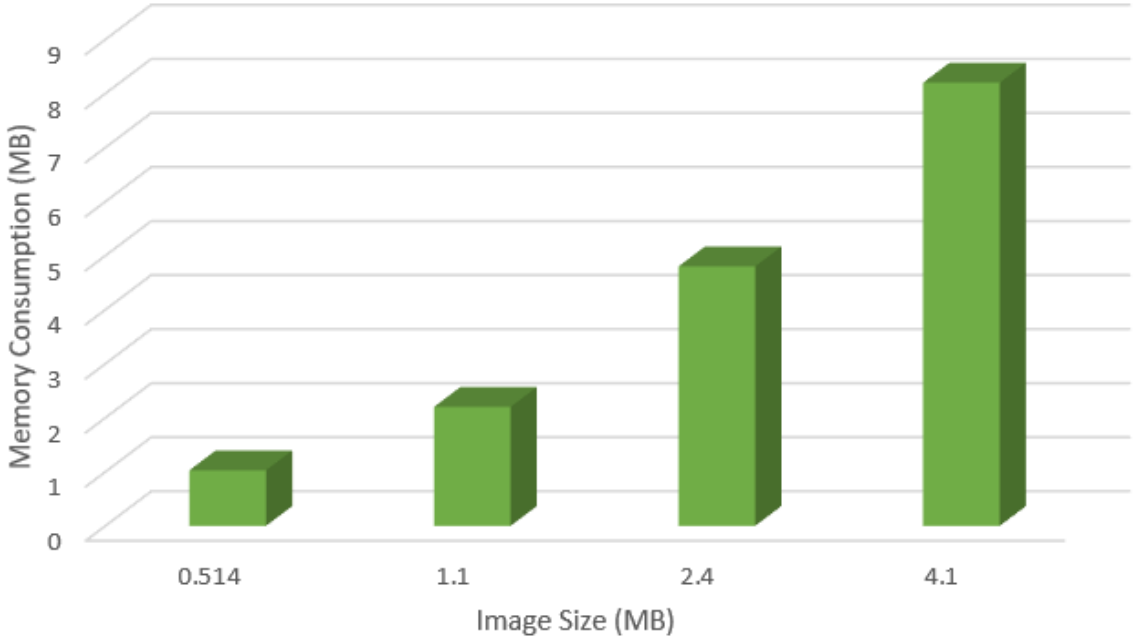
Lossless Compression Algorithm Complexity

	Time Complexity	Memory Complexity
Image compression	O(N*P)	O(N)
Image decompression	O(N)	O(N)

Time and Memory Complexity of the LZ77 image-compression and image-decompression algorithms. N is the size of the image. P is the prefix value or the size of the window the algorithm checks.

Time and Memory Consumption





Time Consumption

Memory Consumption

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Average Compression Ratio

	Compression Ratio
Healthy Cattle	4:3
Sick Cattle	9 : 8

Average compression ratio for Healthy Cattle and Sick Cattle. The tale tells us on average how much was the image compressed by compared to the original image.

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Alejandro Mc Ewen
Universidad Eafit
Colombia
amce@eafit.edu.co

Felipe Henao
Universidad Eafit
Colombia
fhenaog3@eafit.edu.co

Simón Marín
Universidad Eafit
Colombia
smaring1@eafit.edu.co

Mauricio Toro
Universidad Eafit
Colombia
mtorobe@eafit.edu.co

ABSTRACT

Recently, the concept of precision livestock farming (PLF) has emerged, which has the focus of implementing information and communication technologies to improve the process of livestock farming. The problem is that once the data in farms can be digitalized, we need to find a way to make the system more energy efficient. Solving this problem is very important because it can improve the process of precision livestock farming, and thus improve the efficiency of livestock farming. Some related problems are the detection and individual identification of Holstein Friesian cattle, the use of an animal welfare platform for extensive livestock production, and the use of machine learning in precision livestock farming. We propose to use two compression algorithms Nearest Neighbor that is lossy, and the LZ77 is lossless. We couldn't compress the file as much as we would have liked but we still achieved some compression, as for runtime and memory consumption it is appropriate for the purpose of the algorithms. From the work, we realized that we could have used a more effective algorithm for images for the lossless compression.

Keywords

Compression algorithms, machine learning, deep learning, precision livestock farming, animal health.

1. INTRODUCTION

Farming is a very important in the economy and society. So, the more efficient the sector can be the better every is for it. If one can implement technology with farming a lot of process could be made more precise and efficient. This would help fulfill the need for food in the worlds growing population.

1.1. Problem

The problem is that farms don't have a great way to identify sick cattle. The only resource they can use is the famers intuition. With this unprecise method many cattle die because they aren't treated. The problem is to device a more precise method to identify sick cattle.

1.2 Solution

networking infrastructure is very limited, thus data compression is required.

Due to the limited network infrastructure, we implement compression algorithms to make the system more energy efficient. The algorithm we used is the nearest neighbor, a lossy image-compression algorithm, because is easier to implement in comparison to others and it doesn't take an average, instead it selects certain pixels which defines better the lines which results in a clearer image in comparison to other lossy algorithms.

1.3 Article structure

In what follows, in Section 2, we present related work to the problem. Later, in Section 3, we present the data sets and methods used in this research. In Section 4, we present the algorithm design. After, in Section 5, we present the results. Finally, in Section 6, we discuss the results, and we propose some future work directions.

2. RELATED WORK

In what follows, we explain four related works on the domain of animal-health classification and image compression in the context of PLF.

3.1 Computer and electronics in Agriculture

Farms needs to become more efficient to meet the food needs of a growing population. The problem is how can we make farming more efficient. The solution proposed by the article is to use precision livestock farming and machine learning to recognize healthy and not healthy cattle. The paper then does an in-depth investigation on various methods being used a research in this field. They did this with a Boolean search algorithm in various databases including Google Scholar, IIEE Xplore, Scopus, and Springer. After this they search for key words that satisfied the criteria that machine learning was being used for gracing, and that machine was being to enhance precision livestock farming in respects to the animal's health. This gave them 35 articles to use in their analysis. Finally, they ended by stating the limitation and challenges the industry has to solve to make this technology into a success.[10]

3.2 An Animal Welfare Platform for Extensive Livestock

THANK YOU!