|  |
| --- |
| Preliminary report  Zeros and Ones to ATGC’s  Heather Han2, Zichen Liu2 and Adrian Johnston2  [hhan16@jhu.edu](mailto:hhan16@jhu.edu) [ajohn277@jhu.edu](mailto:ajohn277@jhu.edu) [zliu98@jhu.edu](mailto:zliu98@jhu.edu)  1Department of XXXXXXX, Address XXXX etc., 2Department of XXXXXXX, Address XXXX etc.  Abstract  **Motivation:** With all these years of development of computer technology, we can see a trend that people have always been found of storing data in more and more compacted space. DNA has become a potential candidate for the next round of shrinking size for a computer drive because of its high information density property.  **Results:** We has been able to convert binary bit code of a file to ATGC.  **Availability:**  **Contact:**  **Supplementary information:** |

# Introduction

With the need for storing more and more date in a smaller and smaller space, computer drive has shrinking dramatically. Especially, in recent years with the introduction of new generation computer and high-speed internet, the craving for storage has never been so high. In the past decade, we have witnessed a series of remarkable achievement in the transition of drives. We have moved from floppy disks, CDs to flash drives. But when we move to big data era, current storage medium become powerless. The urge for a new storage medium arises. DNA because of its high information density and the similarity to the bit codes in the computer becomes a potential candidate. DNA storage is not a new method that emerges in these years. Actually, it has been around since 1988, J-Craig Venter Institute among other research centers, a nonprofit genomics research organization, is the response for the first successful project. They were able to encode 7920 bits into DNA. Recent DNA synthesizing techniques can improve their way a lot, making it much easier to encode information and decode out.

Just in 2017, Microsoft research center has announced that they are going to create a data storage system using DNA as a medium with a better searching system for the DNA data.

# Methods

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

# Results

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

## Data Structure This is Heading 2 style this is heading 2 style

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

### 3.1.1 This is heading 3 style

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

1. The quick brown fox jumps over the lazy dog.
2. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.
3. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

* The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.
* The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.
* The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

## Unnumbered list style

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

 (1)

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

**Fig. 1. Relation between τ and *t*.** This example has only two continuous Steppers, S1 and S2.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

**Table 1.**Benchmark results of the cascade oscillators model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| |S| | Predicted cost | Timing | Predicted speed | Speed |
| 1 | S219.20(100%) | 68m43s | 1.00 | 1.00 |
| 2 | 29.10+219.10(~50%) | 35m13s | 2.00 | 1.95 |
| 4 | 219.20(100%) | 68m43s | 1.00 | 1.00 |
| 10 | 29.10+219.10(~50%) | 35m13s | 2.00 | 1.95 |
| 20 | 219.20(100%) | 68m43s | 1.00 | 9.5 |

This is table foot note sample text This is table foot note sample text This is table foot note sample text

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.The quick brown fox jumps over the lazy dog.

Acknowledgements

The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog. The quick brown fox jumps over the lazy dog.

Funding

This work has been supported by the …..

*Conflict of Interest:* none declared.

References

Alexandrescu,A. (2001) Modern C++ Design: Generic Programming and Design Patterens Applied. Addision Wesley Professional, Boston.

Dormand,J.R. and Prince,P.J. (1980) A family of embedded Runge–Kutta formulae. *J. Comp. Appl. Math.*, **6**, 19–26.

Alexandrescu,A. (2001) *Modern C++ Design: Generic Programming and Design Patterens Applied.* Addision Wesley Professional, Boston.

Dormand,J.R. and Prince,P.J. (1980) A family of embedded Runge–Kutta formulae. *J. Comp. Appl. Math.*, **6**, 19–26.

Alexandrescu,A. (2001) *Modern C++ Design: Generic Programming and Design Patterens Applied.* Addision Wesley Professional, Boston.

Dormand,J.R. and Prince,P.J. (1980) A family of embedded Runge–Kutta formulae. *J. Comp. Appl. Math.*, **6**, 19–26.

Yoo,M.S. *et al*. (2003) Oxidative stress regulated genes in nigral dopaminergic neurnol cell: correlation with the known pathology in Parkinson’s disease. *Brain Res. Mol. Brain Res.*, **110**(Suppl. 1), 76–84.

Crenshaw, B.,III, and Jones, W.B.,Jr (2003) The future of clinical cancer management: one tumor, one chip. *Bioinformatics*, doi:10.1093/bioinformatics/btn000.

Auhtor,A.B. *et al.* (2000) Chapter title. In Smith, A.C. (ed.), *Book Title*, 2nd edn. Publisher, Location, Vol. 1, pp. ???–???.

Bardet, G. (1920) Sur un syndrome d’obesite infantile avec polydactylie et retinite pigmentaire (contribution a l’etude des formes cliniques de l’obesite hypophysaire). PhD Thesis, name of institution, Paris, France.