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BACKGROUND

Digital production, transmission and storage have revolutionized how we access and use information but have also made archiving an increasingly complex task required active, continuing maintenance of digital media. This challenge has focused some interest on DNA as an attractive target for information storage because of its capacity for high-density information encoding, longevity under easily achieved conditions and proven track record as an information bearer.

Although techniques for manipulating, storing and copying large amounts of existing DNA have been established for many years, one of main challenges for practical DNA-based information storage is the difficulty of synthesizing long sequences of DNA de novo to an exactly specified design.

OPERATING ENVIRONMENT

Computer equipment with normal network conditions.

MAIN INTERFACE AND FUNCTION INTRODUCTION

UESTC-SOFTWARE
DNA Information Storage System

HOME   ENCODE   DECODE   EDIT   ABOUT

BIO101: DNA Information Storage System

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Encode Files and Decode Sequences
Support editable DNA format

DNA is a basic and univeral data storage material in biology choosen by Nature. We can use artificial DNA sequences synthesized with commerically available oligonucleotide synthesis machines to store information and use DNA sequencing machines for retrival. As an information storage material, DNA has many advantages compared with electronic materials currently in use, such as high capacity, large density and long shelf-life, if held in right conditions.

To use DNA for information storage in this electronic computer era, we need to devise a protocol to convert traditional computer files into DNA molecules and retreive the information given the sequenced DNA data. Bio101:DNA Information Storage System is such a bridge between bits and nucleotids, i.e. between the current information techology (IT) world and the future biotechnology (BT) computing world, and it is designed for the information transformation between computer files and DNA sequences. It also provides a version responding to DNA editing, bringing informaiton edit into reality.

Encode   Decode   Edit   About

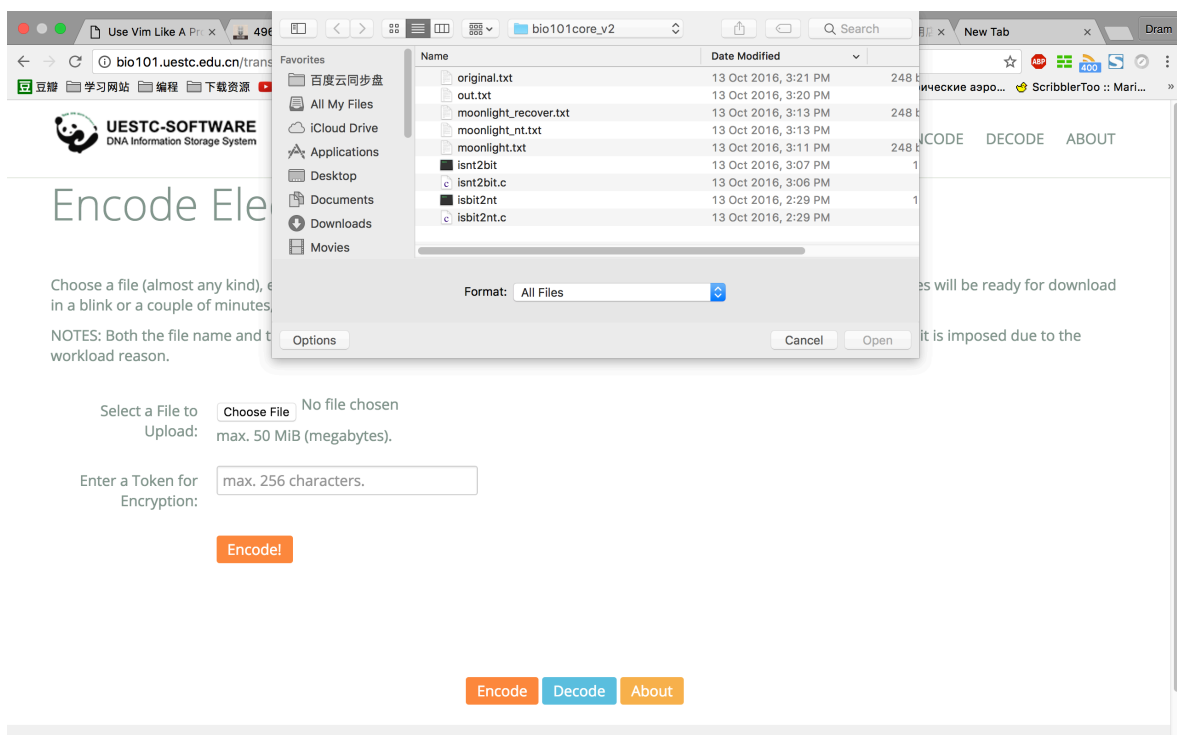## MAIN INTERFACE
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Fig.1 Main Interface

In the main interface, users can click 'Encode', 'Decode' or 'Edit' button to jump to corresponding function interface. At the bottom of home page, there is a navigation bar. Users can jump to any page quickly by clicking the corresponding buttons. They can also click 'About' button to learn our algorithm and design.
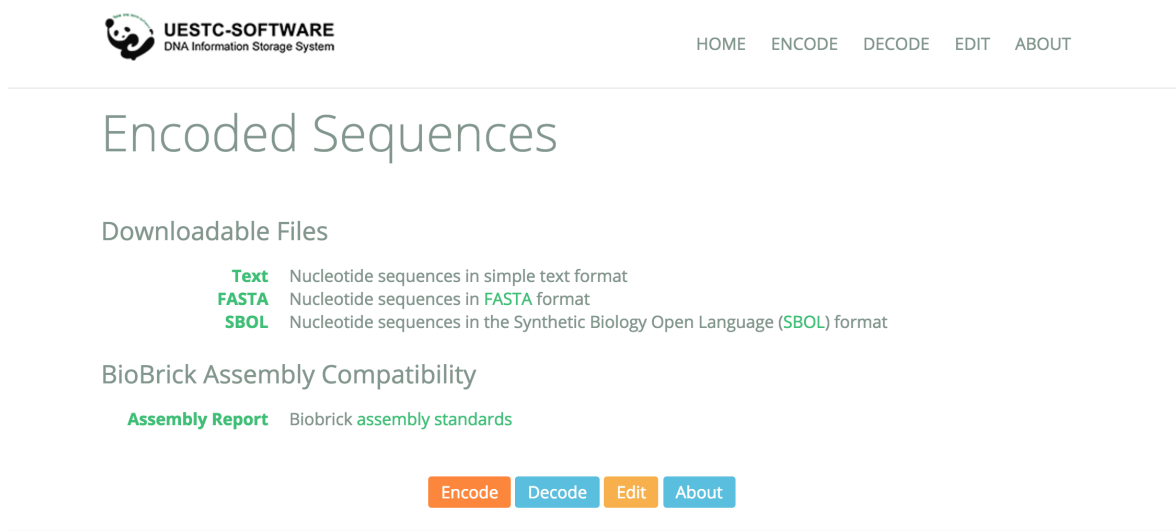
'ENCODE' INTERFACE
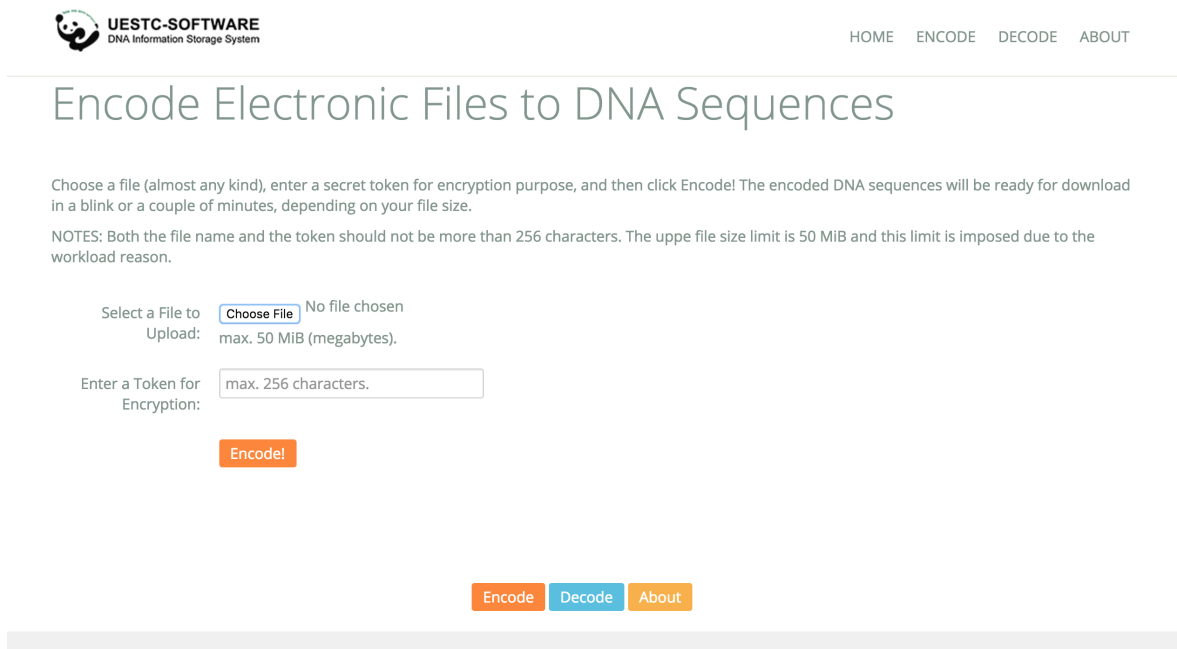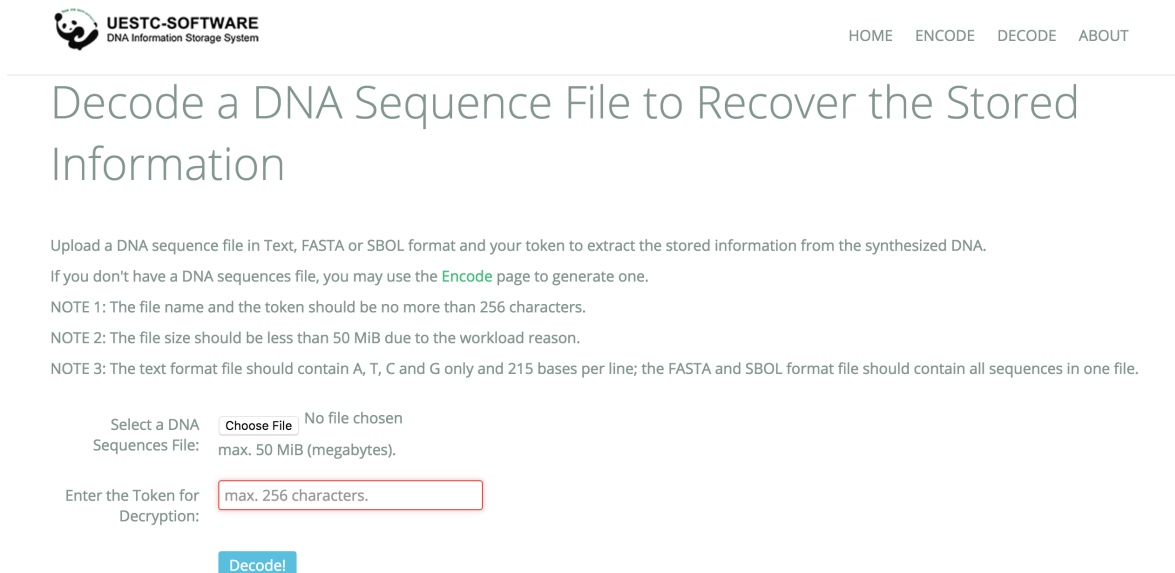

Fig.2 'Encode' Interface
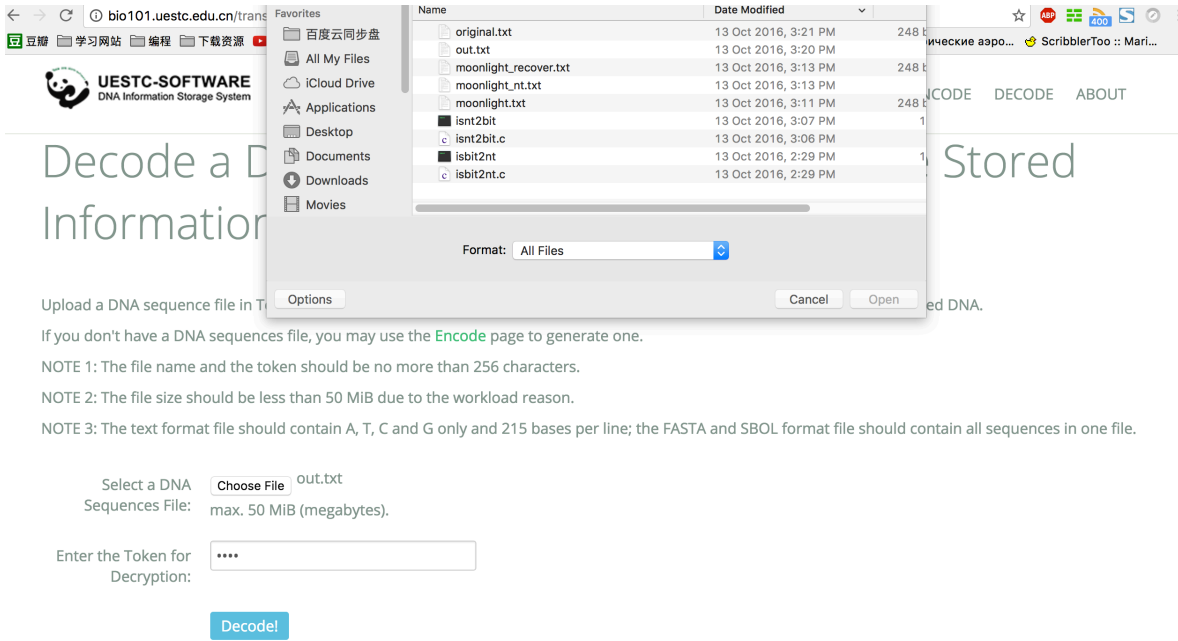
Fig.3 Select Local File

Fig.4 Completion and Download

In 'Encode' interface, users need to choose a file for encoding, enter specific token for this file. Since token is the key for later progress, is should be remembered. After entering Token for this file, user can submit and get result.There are three different common formats for downloading. There is also an assembly report for Biosafety issues.
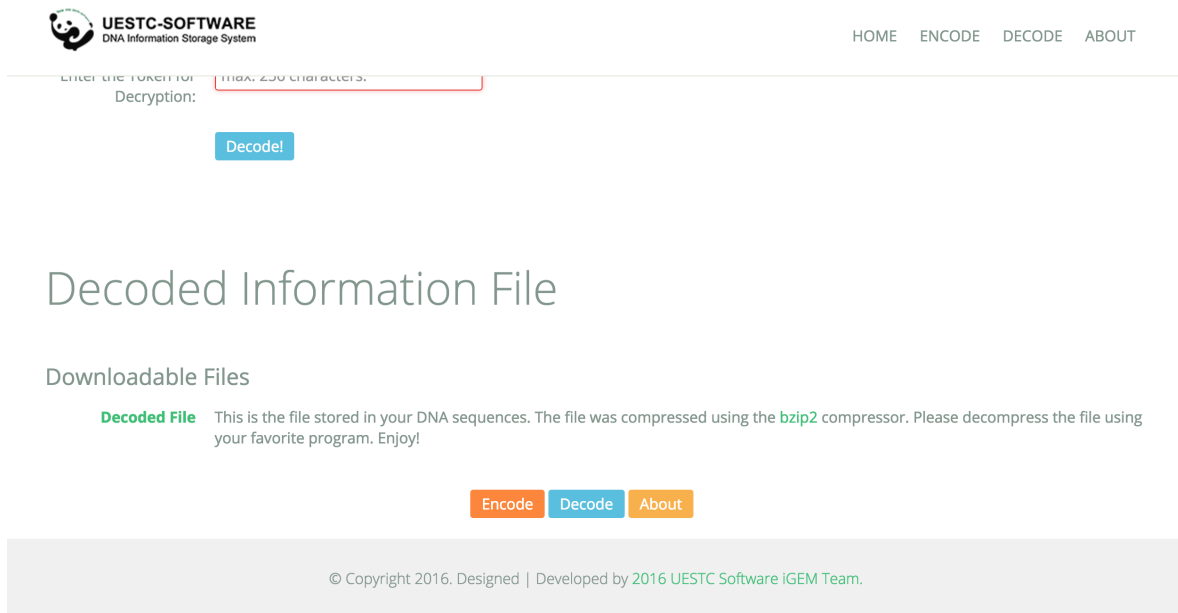
'DECODE' INTERFACE

Fig.5 'Decode' Interface

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Fig.6 Select Local File

Fig.7 Completion and Download

In this interface, users are supposed to upload an encoded file, and submit all necessary bits as a whole. Token should be right, and there will a download hyperlink.Download it, the user can extract the information he stored.

'EDIT' INTERFACE

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Edit Electronic Files to DNA Sequences

Submit the DNA fragment and your token to decode it firstly, then edit this content to acquire new segment for substitution.

Result will be displayed as text directly, but you can also download it as SBOL file

NOTE 1:Length of sequence must keep same.

NOTE 2:The Token of default example is "123".

NOTE 3:Token should keep same since enter.

original fragment:

```
TACGTACGTACGTAGGCTTTGGTATACGAGCAGGTTGAATGCGCCTATGCATCATAGGCGTTCATTGTACAGATCCATTGTGTTGTACGTTAGCCCCGCAATTTGGCGGAC
GATGGGAACATATATCCATGCTCACACCCTGCCG
```

Encrypte code:

Submit!

Encode   Decode   Edit   About

Fig.8 'Edit' Interface

Edit Electronic Files to DNA Sequences

Submit the DNA fragment and your token to decode it firstly, then edit this content to acquire new segment for substitution.

Result will be displayed as text directly, but you can also download it as SBOL file

NOTE 1:Length of sequence must keep same.

NOTE 2:The Token of default example is "123".

NOTE 3:Token should keep same since enter.

edit information:

```
A Quiet Night Tought
Li Bai (Tan
```

Enter the Token for edit:

Submit!

Fig.9 Decode Single Segment

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Li Bai (Tan

Enter the Token for edit:

Submit!

Results

original fragment:

TACGTACGTACGTAGGCTTTGGTATACGAGCAGGTTGAATGCGCCTATGCATCATAGGCGTTCATTGTACAGATCCATTGTGTTGTACGTTAGCCCCGCAATTTGGCGGACGATGGGAAC

editted fragment:

TACGTACGTACGTAGGCTTTGGTATACGAGCAGGTTGAATGCGCCTATGCATCATAGGCGTTCATTGTACAGCCAACGCTGAATAAACGCTCAAGCGATCCGCTTACTGGCGGGTGAA

SBOL-XML File   This is the file stored in your DNA sequences. The file was compressed using the bzip2 compressor. Please decompress the file using your favorite program. Enjoy!

Encode   Decode   Edit   About

Fig.10 Completion and Download

In this interface, the user can put a single segment which he want to edit.With correct token, Bio101 will encode it independently.Since the user edits its content, we will provide a new segment for substitution.
The result will be show as text and be downloaded as SBOL-XML file.

'ABOUT' INTERFACE

About BIO101: Design and Algorithm

Background

Living in an era of information explosion, digital production, transmission and storage so far have not only revolutionized the way information is accessed and used, but also have made archiving of information an increasingly complex task . Have you been perplexed by vast quantities of information? And have you ever image that there exists a practical, high-capacity, low-maintenance, and even self-copy information storage medium which would be still useful after thousands of years? It wouldn't be only a dreamy illusion anymore because of the appearance of great DNA storage technology.
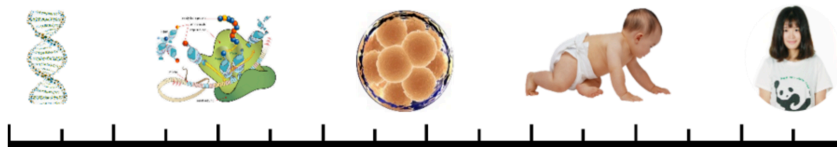
Figure 1. Genome controls the growth and development of human being.

DNA, one of the most miraculous masterpiece created by nature as the stable genetic material, hold a great promise for high-density, long-term and massive information. For example, human genome, just 3 billion base pairs, contains all of the complex biotic information of human being, including chemical molecules forming, cell growth, human developing and so on **(Figure 1)**. Reversely why can't we utilize DNA to store messages? Researches indicate that it is extremely dense, and spectacular high-capacity with a raw limit of 1 exabyte/mm^3(109 GB/mm^3). In other word, every gram of DNA is equivalent to 14 thousand of 50GB blue-ray discs or 233 3TB hard disks heavy of 151 kilos. Meanwhile, compared with now comprehensively used information storage

Fig.11 'About' Interface

In 'About' page, we explain the background theory and algorithm in details. There are design details and enough references, but you can still click this cute panda to visit our WIKI page for massive information.

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