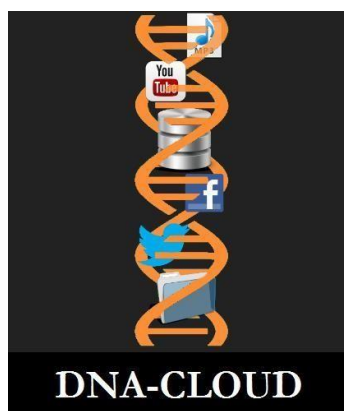


## **DNA Cloud 3.14**

### **User Manual**



### DNA Cloud

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<http://www.guptalab.org/dnacloud>

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**Manish K Gupta.**

Documentation version 3.14

This file was last modified on June 29, 2022.

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### **Credits & Team**

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**System Logo:** Foram Joshi

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### **Acknowledgments**

We would like to thank Thorsten Weimann and Anand B Pillai whose open source libraries ([python-barcode](#) and [pytxt2pdf](#) respectively) have been used in the software.

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## **General Information**

### **1. Introduction**

The world data increase two-fold every year. To store this huge data is burning issue. Since time immemorial, mankind has wanted to share and use information for later use. First, it was through the caveman paintings and symbols. Then we invented the alphabets, ideograms, numbers and other symbols. Using these, books were written and stored for future generations, in palm leaves, papyrus sheets or paper. The invention of printing brought the Gutenberg revolution, making multiple copies easily and spreading education to millions of people. Printed books occupy space. Libraries and archives are bursting at the seams. Enter the computer age and digitization using the binary code of combining zeros and ones (0,1) for alphabets and other such symbols, and reading them using the on-off electrical signals, which has made electronic storage possible, cutting down the size and space for „hard copies“. Integrated circuits, processors and related electronic wizardry have shrunk the size of computers and storage devices from room-size to finger nail size. But the storage and maintenance on this energy craving devices is burdensome. With the idea of using the natural hard drive DNA as storage device, Goldman 2013 *et al* [1] and Church 2012 *et al* [2] had stored file of size one Peta Bytes on 1 gram of DNA. Inspired from the work of Goldman, we have developed the software DNA Cloud for encoding and decoding the file to DNA. We have used the encoding and decoding method described by the Goldman in [1]. We have made the encoding and decoding procedure memory efficient.

### **2. Overview**

DNA Cloud has been primarily developed to facilitate the storage of data in DNA. The software encourages the users to encode and decode the data. It converts any type of data into DNA strings and enables it to store in DNA. Also, it helps to retrieve the data stored in DNA.

### **3. Product Scope**

This software provides the user with:

- Encode any type of data (text, image, audio, video, etc.) to DNA string.
- Decode the data stored in the DNA string.
- Estimator is used to estimate the total length of DNA string used to convert the data and also the cost for the storage of DNA strings.
- Export the converted data to various feasible formats for different application.

#### **4. Product Perspective**

This product's main aim is to make the process of making the computerization and computation of DNA storage user friendly.

##### **System Summary**




Operating Systems – Windows, Mac OS, Linux

This software requires the system to have specifications similar to: - Processor of .2.4 GHz Core 2 Duo, 100 MB Hard Disk, 1GB Random Access Memory and Basic peripherals like keyboard, mouse etc.



##### **Getting Started**

Once you have successfully installed the software, open DNA Cloud by double clicking on the icon available on your desktop screen, a window with seven menu options on the menu bar will appear. Software has following main sections.


**File menu** includes following option:

-  Encode (CTRL+E)
-  Decode (CTRL+D)
-  Exit (CTRL+Q)

**Tools menu** includes following option:

-  Storage Estimator
-  Cost Estimator



**About menu** includes following option:

-  Version information






**Follow Us menu** includes following option:

-  Gupta Lab
-  GitHub
-  LinkedIn
-  Twitter
-  YouTube

**Contact Us menu** includes following option:

-  Email Id
-  Gupta Lab  
Contact us  
page

**Help menu** includes following option:

-  User Manual
-  Product Demo
-  Product Feedback
-  Credits
-  About Us

➤ As you click on the DNA cloud icon, the screen appears as shown in Figure 1.

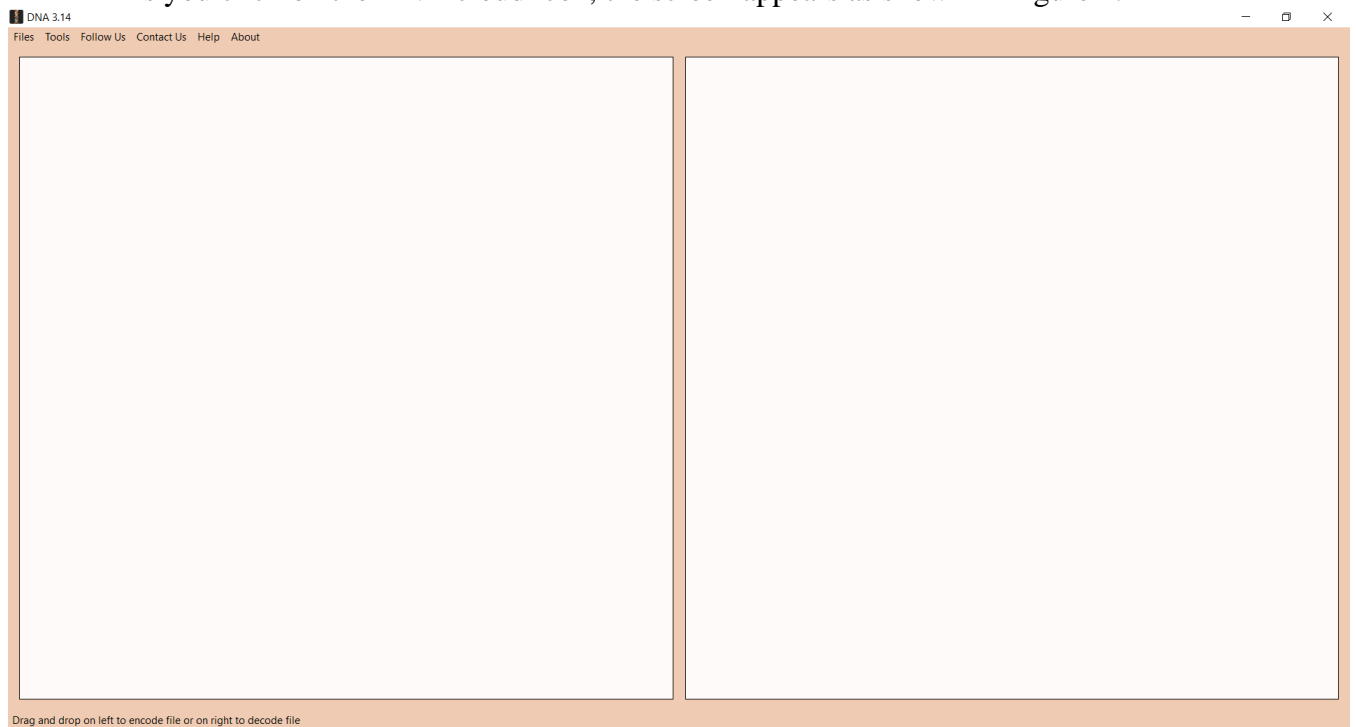


Figure 1. Home page of DNA Cloud

## 5. **Encode**

This option is available under the File menu which will convert any type of data to DNA strings. Then select the file you want to Encode from the Dialogue box. Then select the method

Goldman/Golay with which you want to encode your file (Figure 2). When the user clicks on Ok option, the screen appears as shown in Figure 3.

It will generate the file with extension. dnac that has DNA string for the file selected.

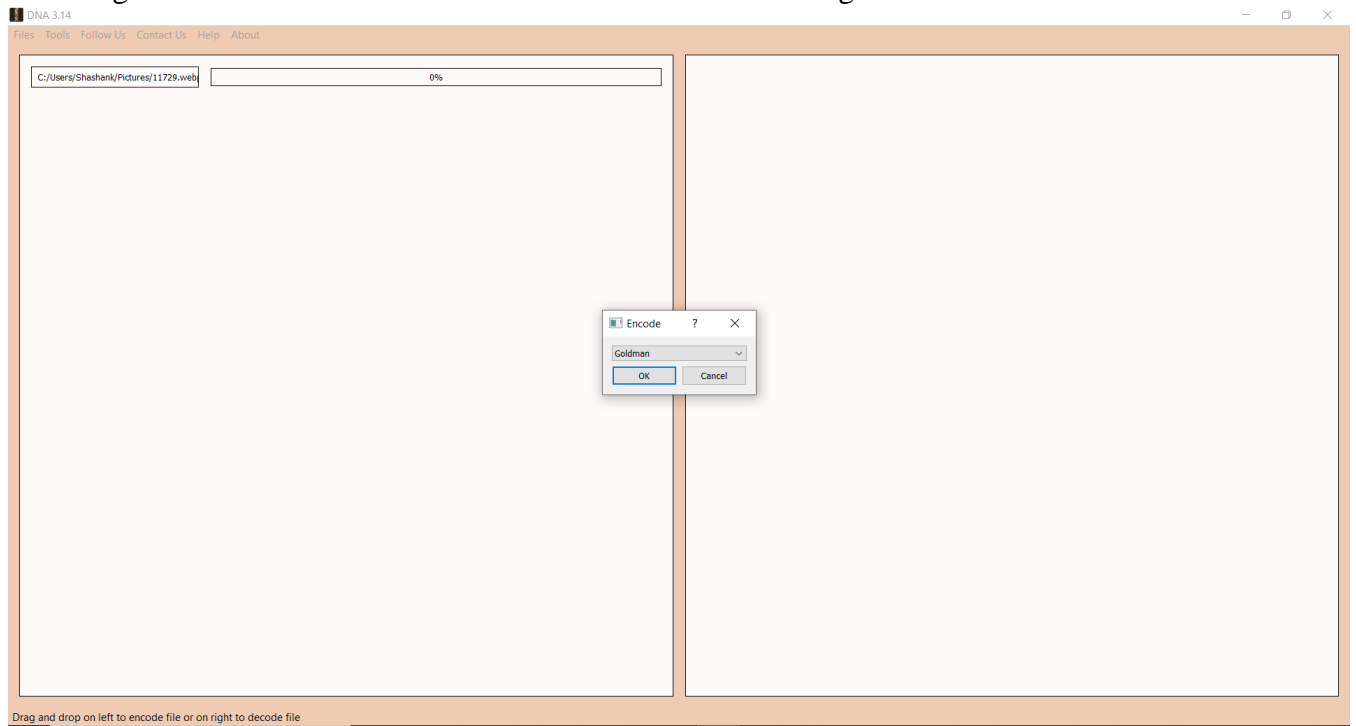


Figure 2 Encoding method selection

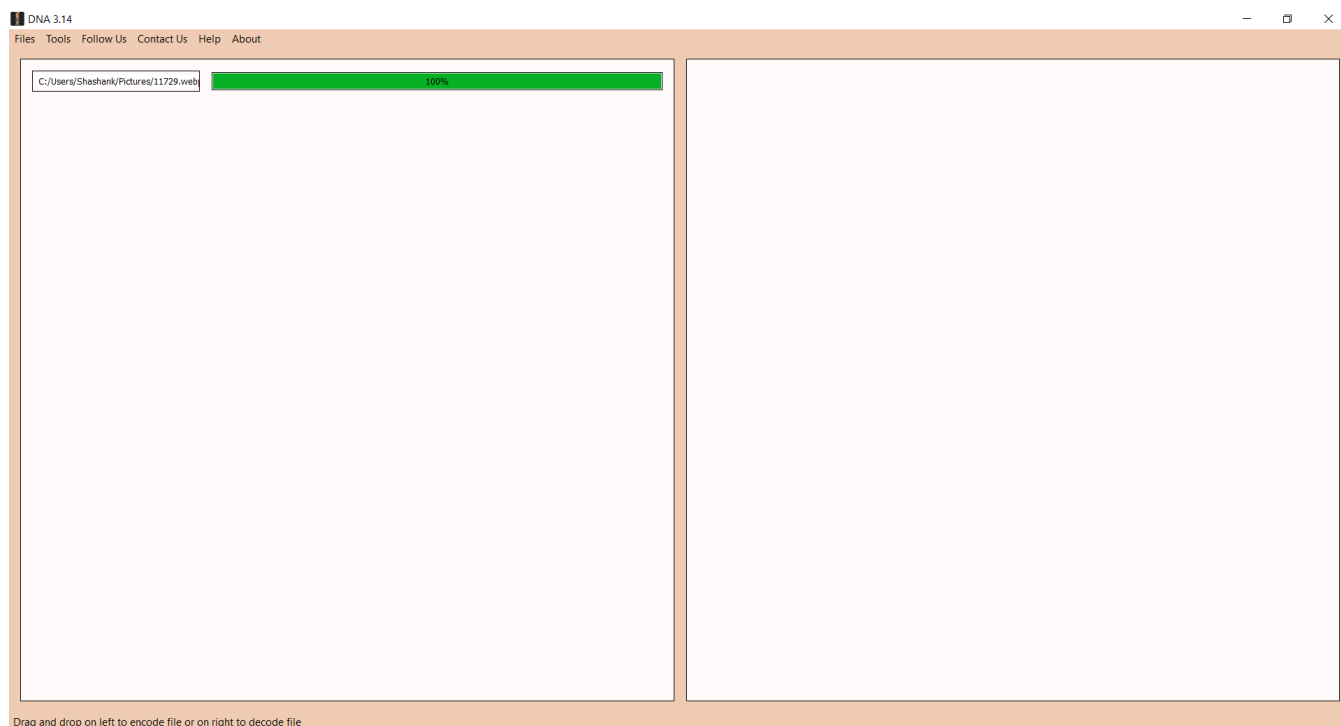


Figure 3 .dnac File created

## 6. Decode

This option is available under the File menu which will convert any .dnac file of DNA strings to original file. Then select the file you want to Decode from the Dialogue box. Then select the method Goldman/Golay with which you want to Decode your file (Figure 3). When the user clicks on Ok option, the screen appears as shown in Figure 4.

It will generate the file with original file extension.



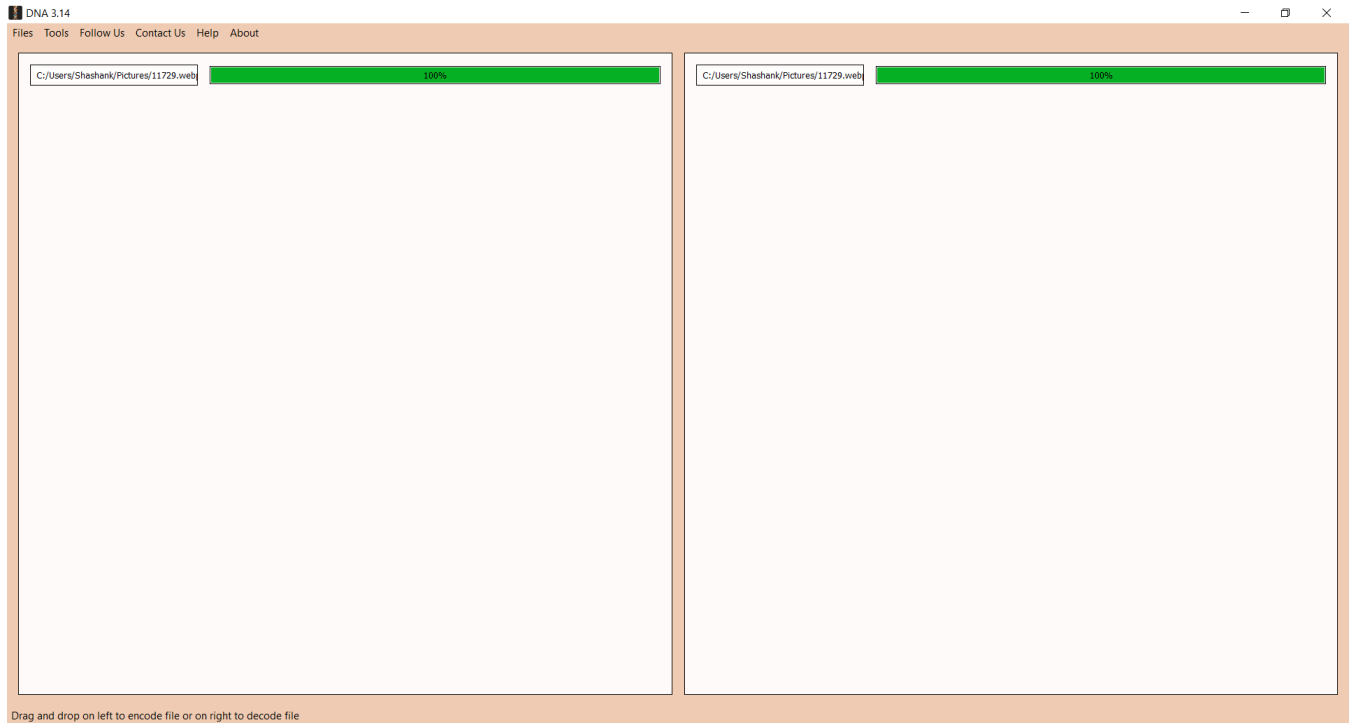


Figure 4 DNA to File (Decode)

## 7. **Estimator**

This will give various statistics for encoded file of DNA strings. Estimator has two main sections.

### **Storage Estimator**

User can select the file to be encoded from the system and the following values of the file are estimated as given in Figure 5.

The Dialog box contains below attributes:

- File size in bytes
- Encoding type (you can select Goldman/Golay)
- Size of file containing DNA strings

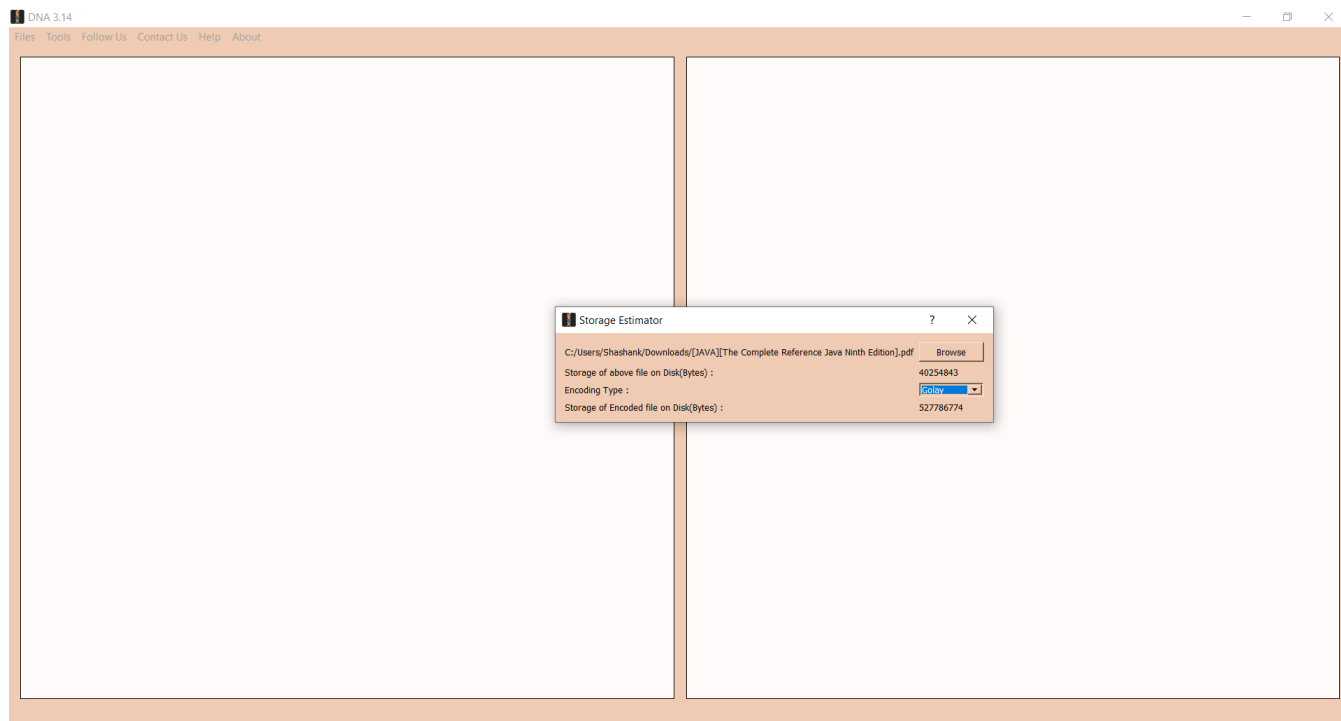


Figure 5 Estimate of Memory required for encoding the file to DNA

### Cost Estimator

This will estimate the cost required to synthesis DNA of the DNA sequence used to store the data. Select .dnac file from the system using browse option which contains the DNA sequences to estimate the properties (Figure 6).

The Dialog box contains below attributes:

- Cost per DNA
- Encoding type
- Total cost

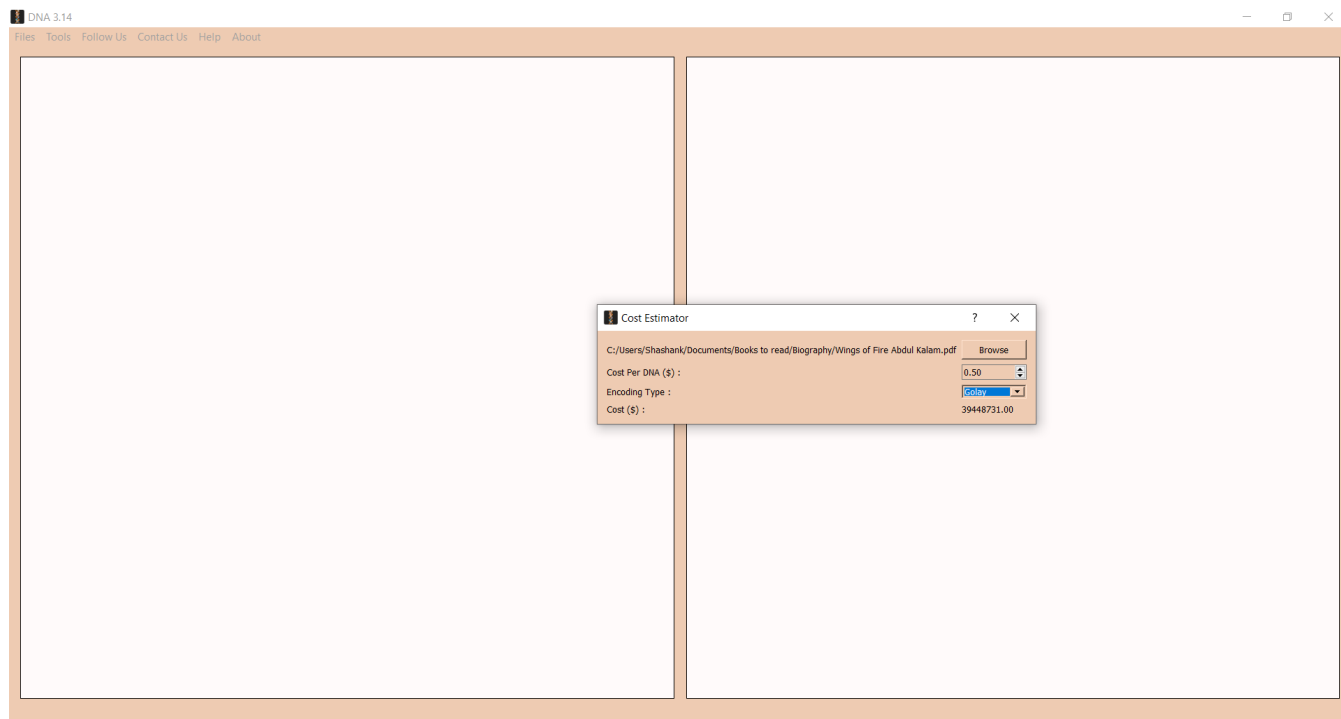


Figure 6 Cost Estimator for given .dnac file

## 8. **About**

This will show version information.

## 9. **Follow Us**

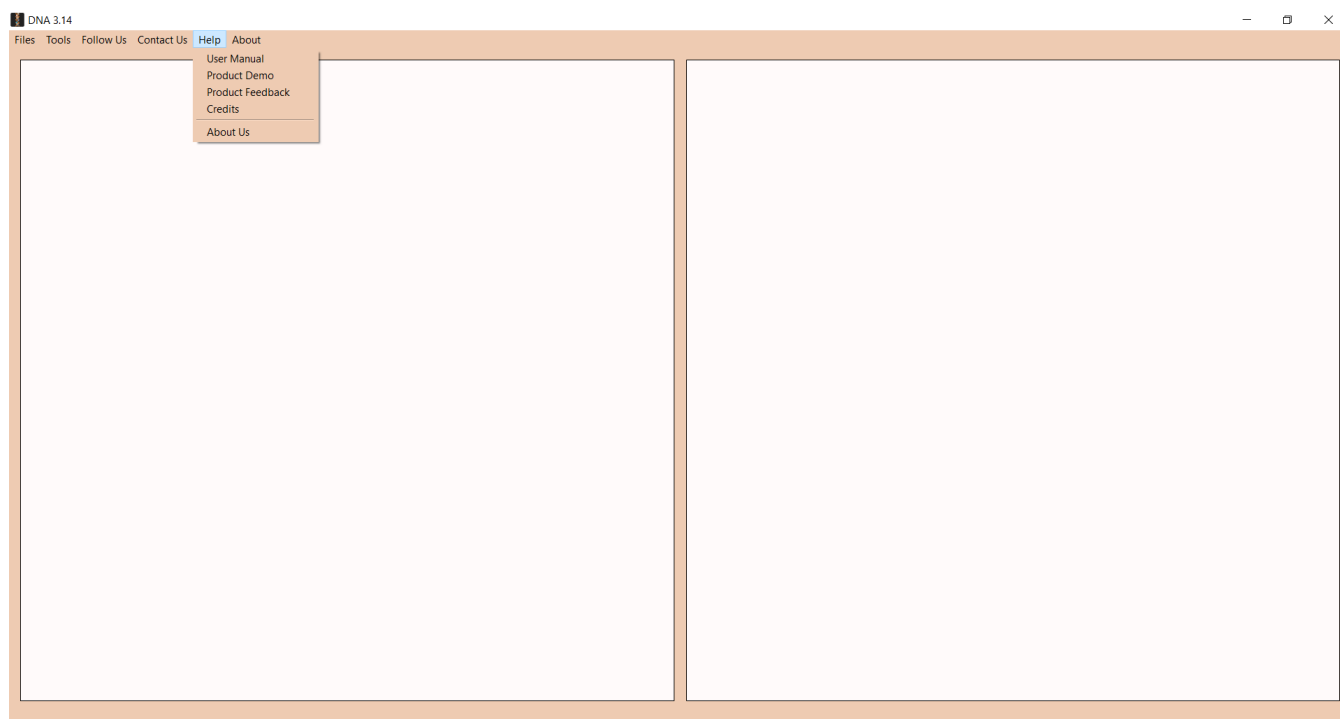
This menu helps you to follow us via Gupta Lab, GitHub, LinkedIn, Twitter or YouTube.

## 10. **Contact Us**

In Case of any difficulties, you can contact us via Email Id, Phone number, Fax number, Address or via Gupta Lab website.

## 11. **Help**

It contains User manual, Product Demo, Product Demo, Product Feedback, Credits and About us (Figure 7).



- First option will open default User Manual document in user's default PDF reader software
- Second option product demo will open the homepage of DNA Cloud where the demo is available.
- Third option will open the feedback form where you can give feedback for the software.

Finally, About Us option recognize the contributors in this project. Which contains information like logo of the software, version of the software, name of the software, License of the software, Credits button and URL of the software. On pressing “Credits”, it opens a PDF document for the credits.

## Support and Feedback

Users are requested to contact team at the email [dnacloud@guptalab.org](mailto:dnacloud@guptalab.org) for feedback and any other issues with the software. Two platform specific installers (Windows and Mac and Linux) are available on the project home page along with source code with open source license agreement.

## References

1. Goldman, Nick, et al. "Towards practical, high-capacity, low-maintenance information storage in synthesized DNA." *Nature* (2013).
2. Church, George M., Yuan Gao, and Sriram Kosuri. "Next-generation digital information storage in DNA." *Science* 337.6102 (2012): 1628-1628.
3. On optimal family of codes for archival DNA Storage-  
<https://ieeexplore.ieee.org/abstract/document/7458386>