

# Designing and Simulating the Self-Assembly of DNA Nanostructures and DNA Computers

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# Problems

- Current process of transforming nanostructure designs into a set of DNA strands is tedious and requires many independent software packages
- Researchers waste time importing, exporting, transferring, and re-formatting DNA strand data
- Errors and mismatches in DNA strands can waste thousands of research dollars

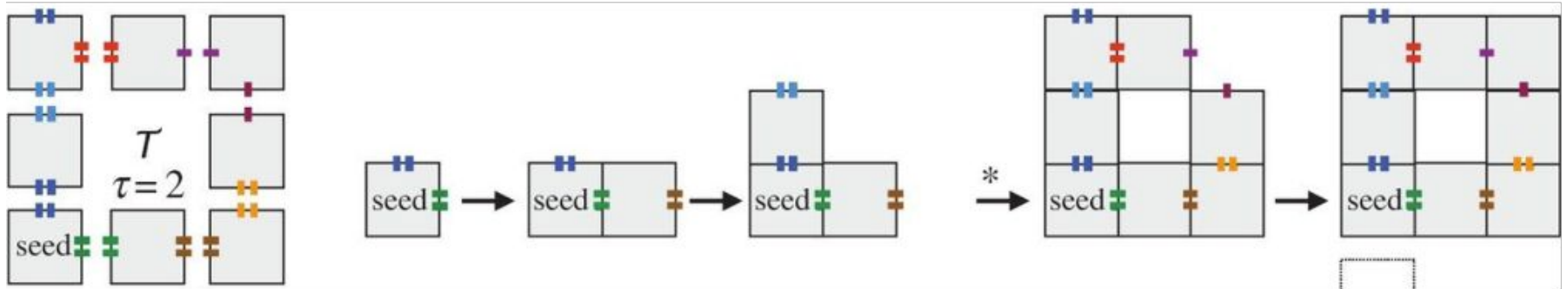
# The Objective

Simplify the Process

- To transform an abstract nanostructure tile assembly design into a DNA strand diagram with a click of a button
  - No longer having to use multiple independent software packages
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# DNA Nanotechnology

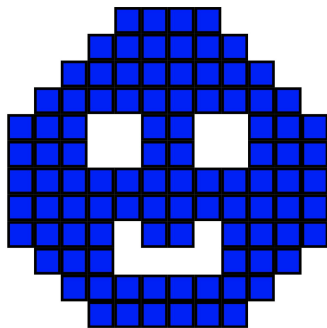
- Strands of synthetic DNA can be designed to bind in a controlled and predictable process which allows arbitrary DNA structures to be created at the nanoscale
- DNA strands are conceptually organized into rectangular structures called tiles
- Tiles are the fundamental building unit in tile assembly structures



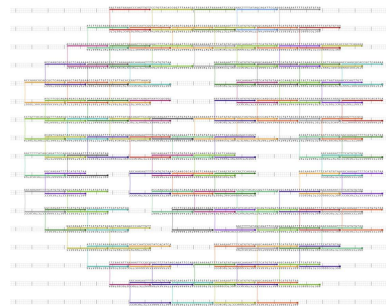
**Design**

# Requirements

- User can upload a tile assembly, tile strands, and DNA sequence file
- User receives a DNA strand diagram that can be downloaded and/or opened in app
- App must be hosted on a web server
- Clear and understandable user interface and user experience
- Provide progress updates while the computation is taking place

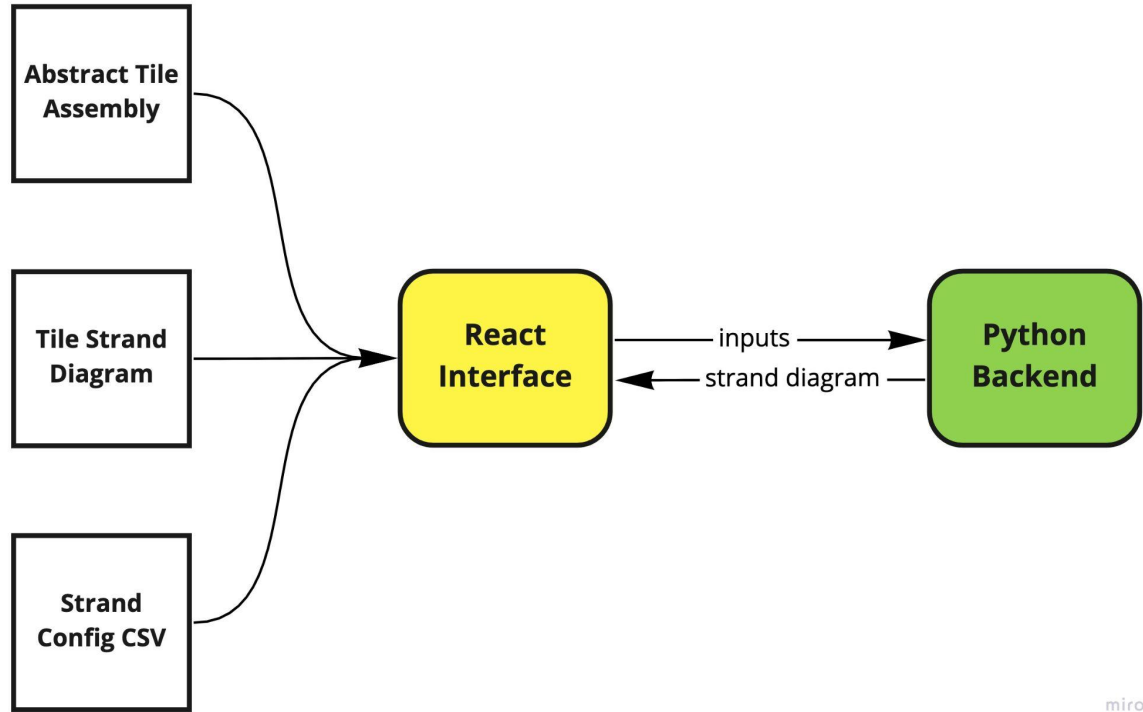


**Input:** Abstract tile assembly



**Output:** Strand diagram

# Proposed Application Architecture



# Tasks

## Research

Understand current DNA strand visualization and DNA tile assembly creation process

## Implement

Split into frontend and backend teams to implement

## Design

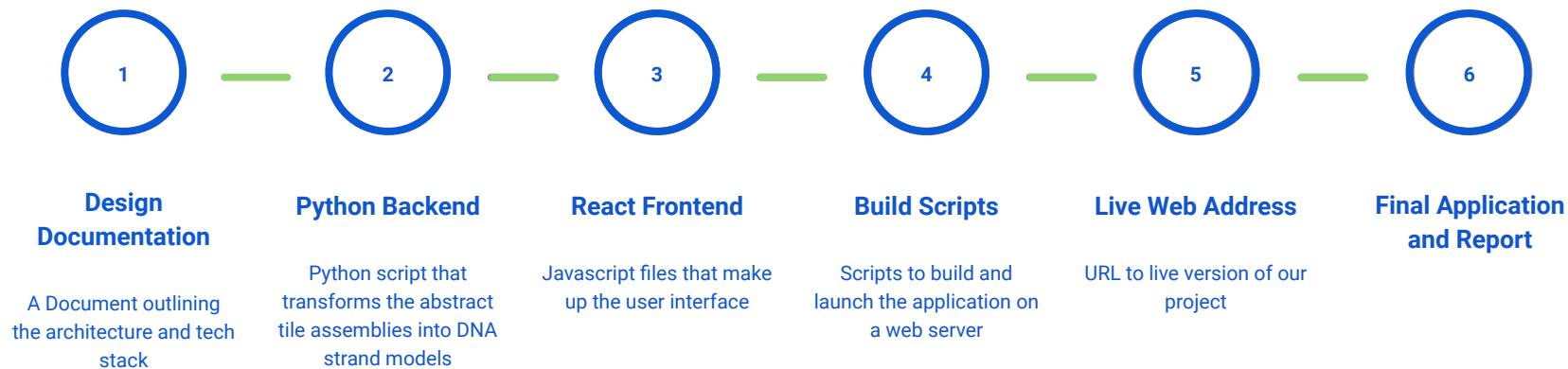
Design and prototype the frontend user interface; Plan the backend

## Test

Test the user interface with multiple valid and invalid inputs



# Project Deliverables



# Dr. Trent Rogers

Project Sponsor

- Graduated from the University of Arkansas with a Ph.D in Computer Science in 2019
  - Postdoctoral researcher at Maynooth University researching self assembling and self organizing systems
  - National Science Foundation Graduate Research Fellow
  - Recipient of the Doctoral Academy Fellowship as a Ph. D student
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