Retrospective Sprint 4
of
Group BLOCKS7PG

Block Model Compression Algorithm

a1162576 Karl Asenstorfer

a1806297 Po-Yi Lee

a1804817 Xiaoman Li

a1784375 Yuanpeng Liu

a1782685 Yang Lu

a1797683 Jiaping Qi

a1786785 Hechen Wang

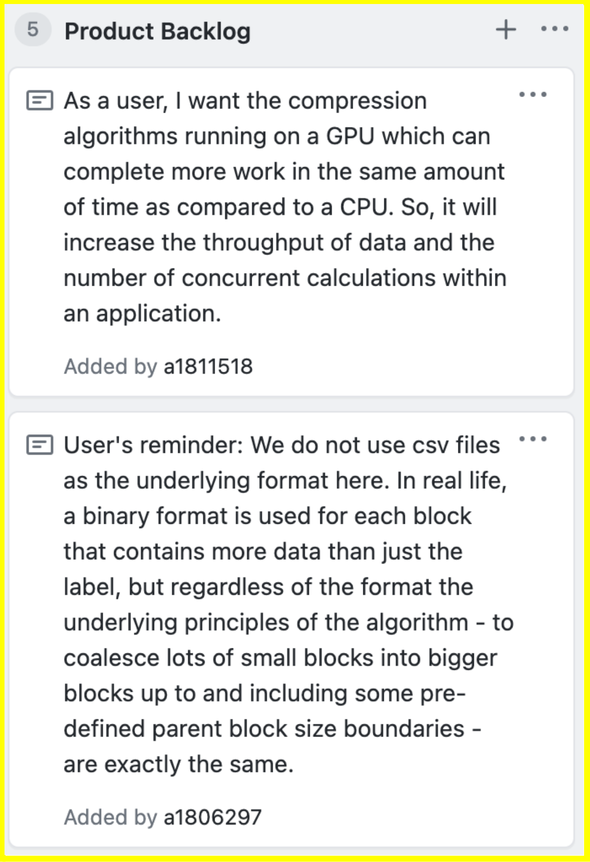
a1784184 Kaiyang Xue

a1811518 Liuyang Yun

Snapshot Week 9 of Group BLOCKS7PG

Product Backlog and Task Board

Product Backlog:



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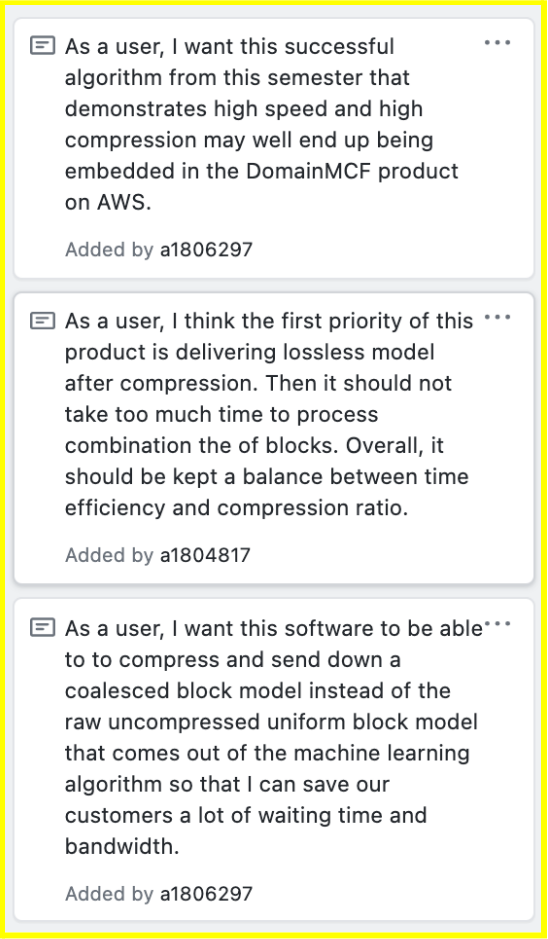

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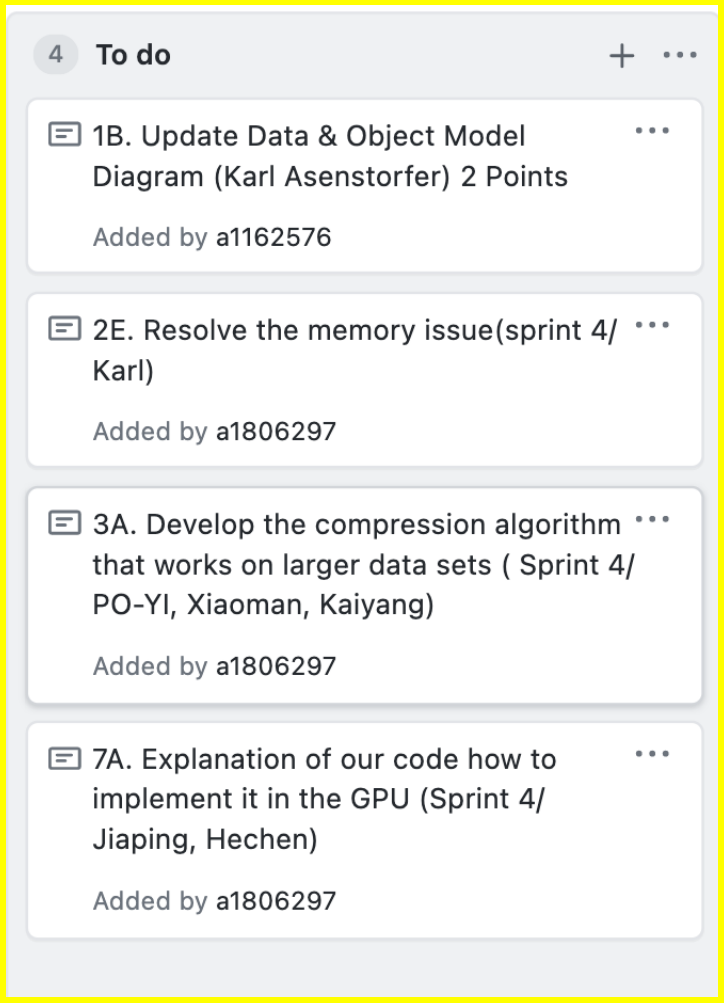

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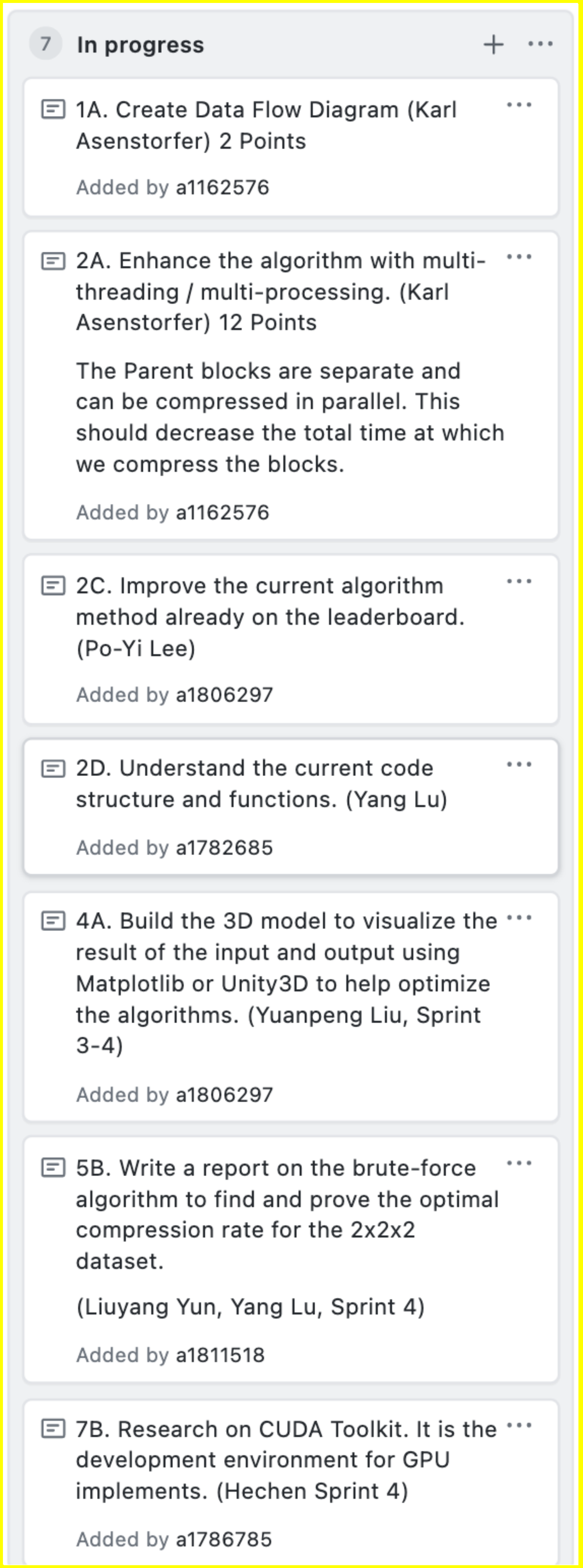

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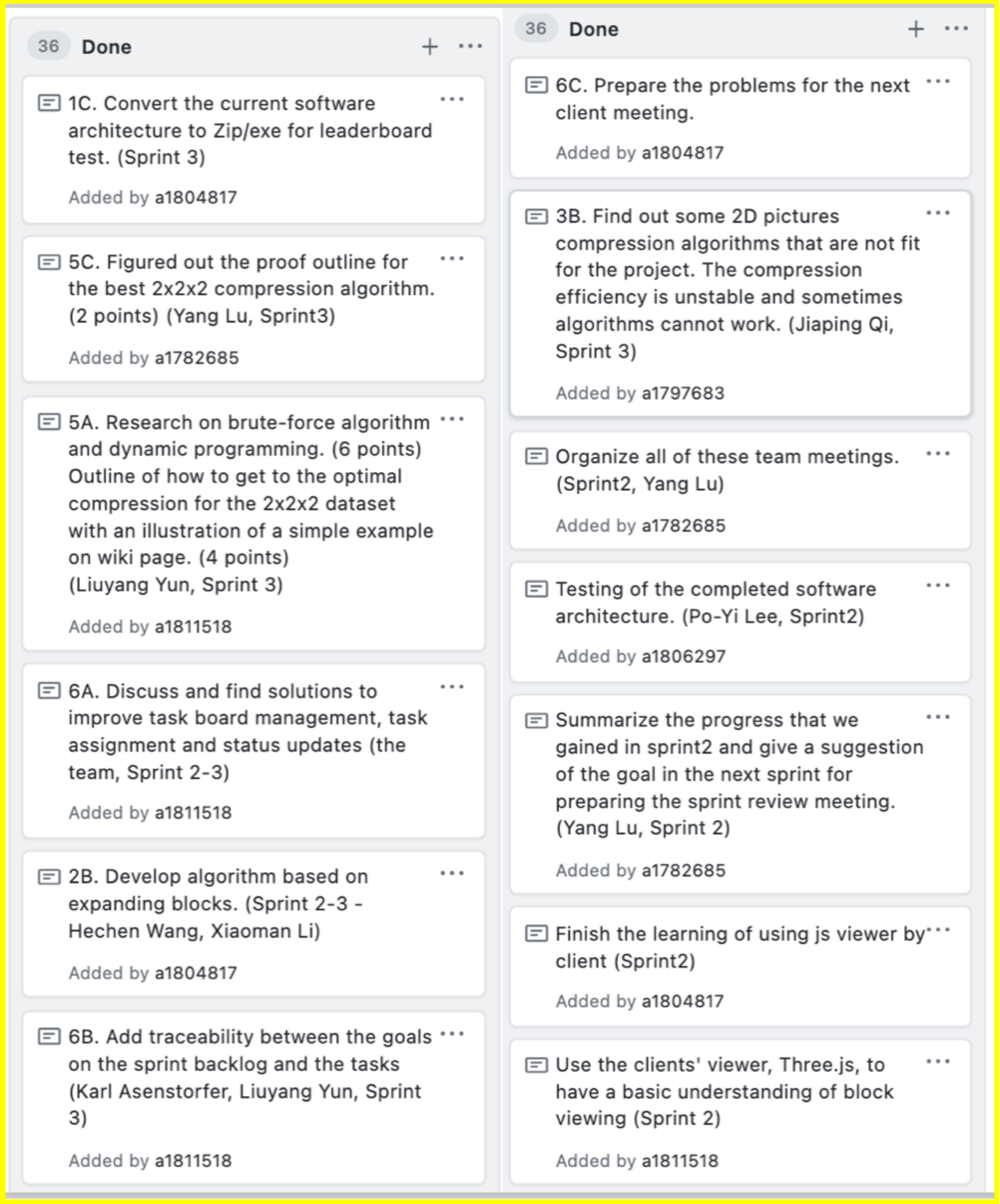

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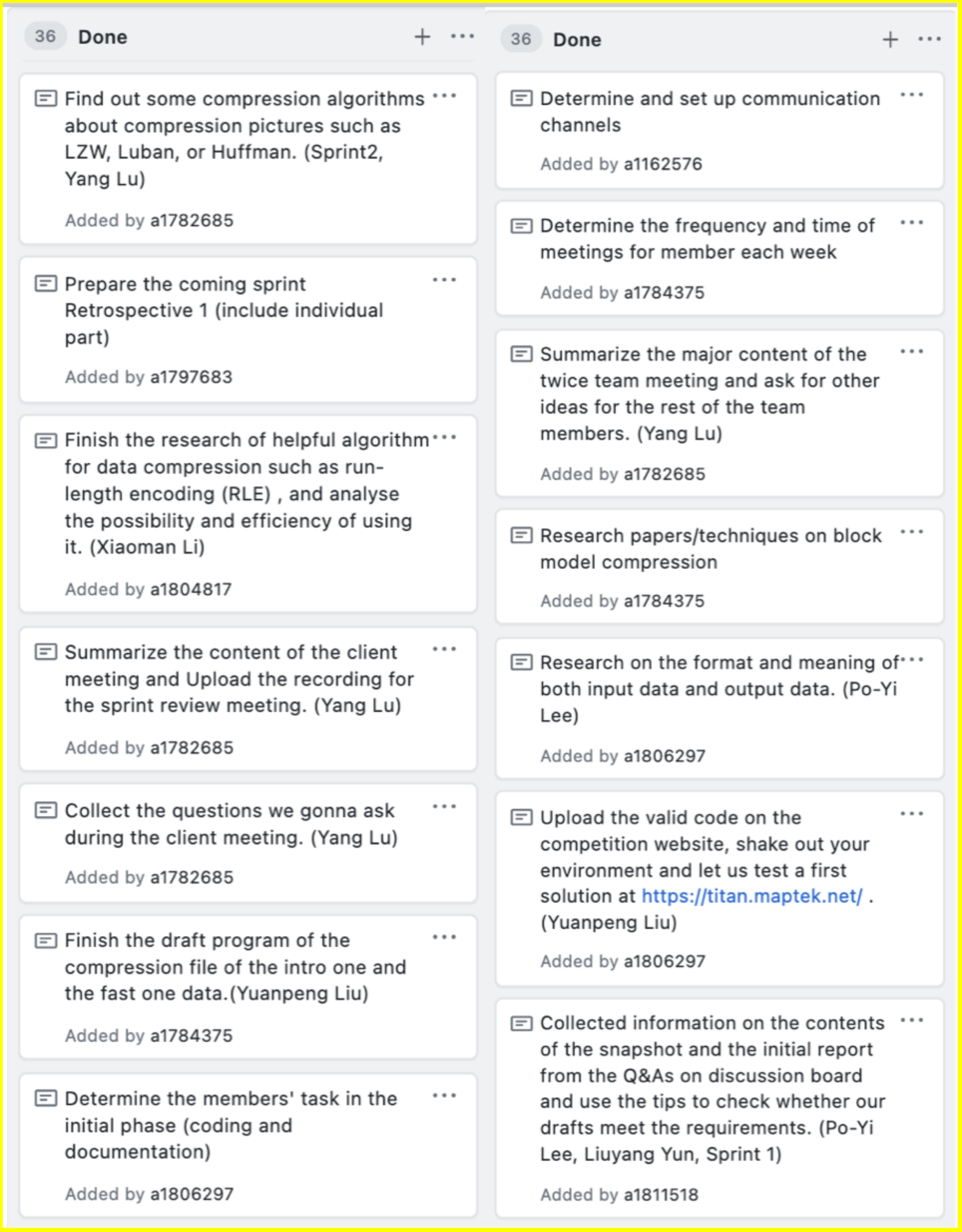

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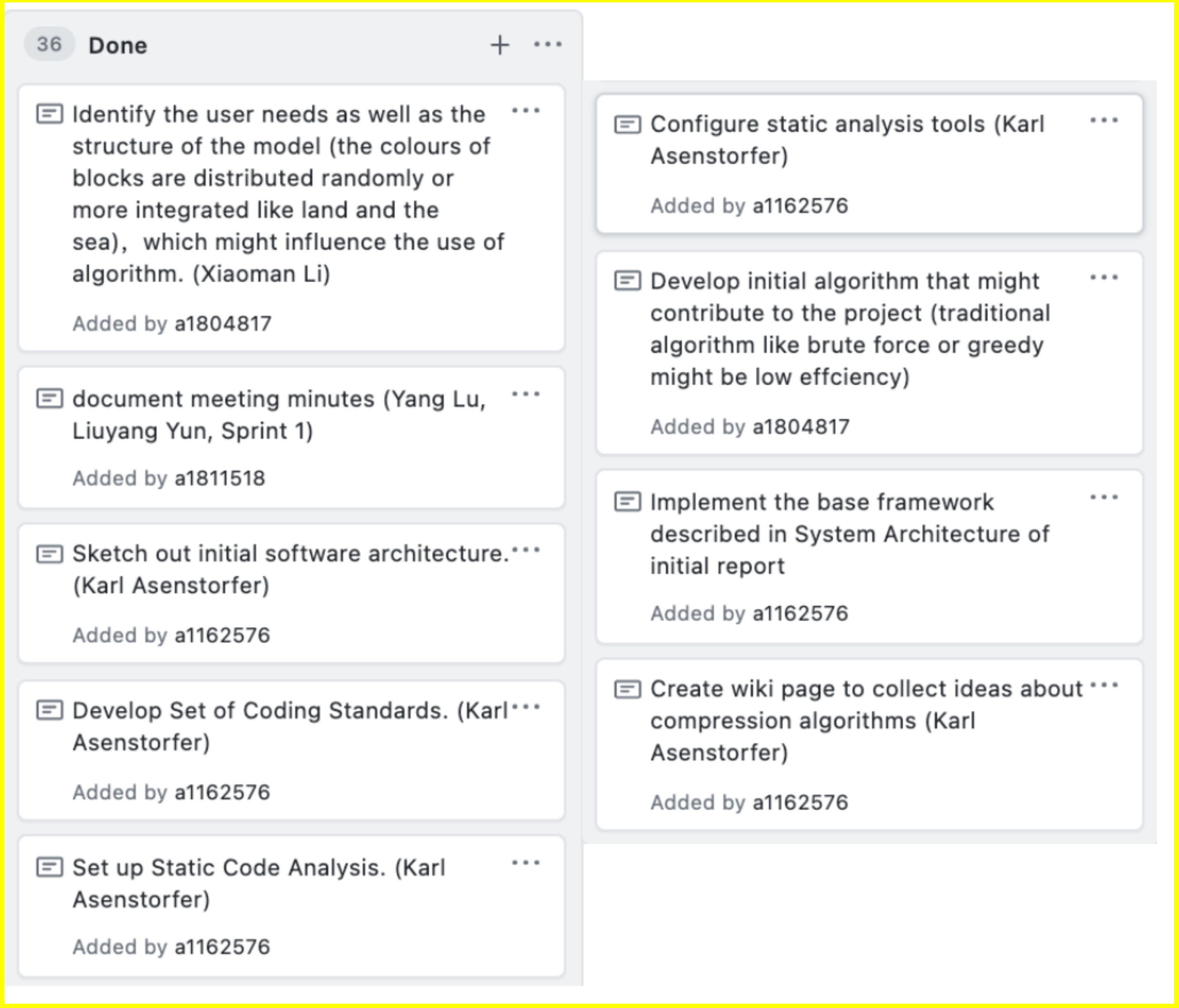

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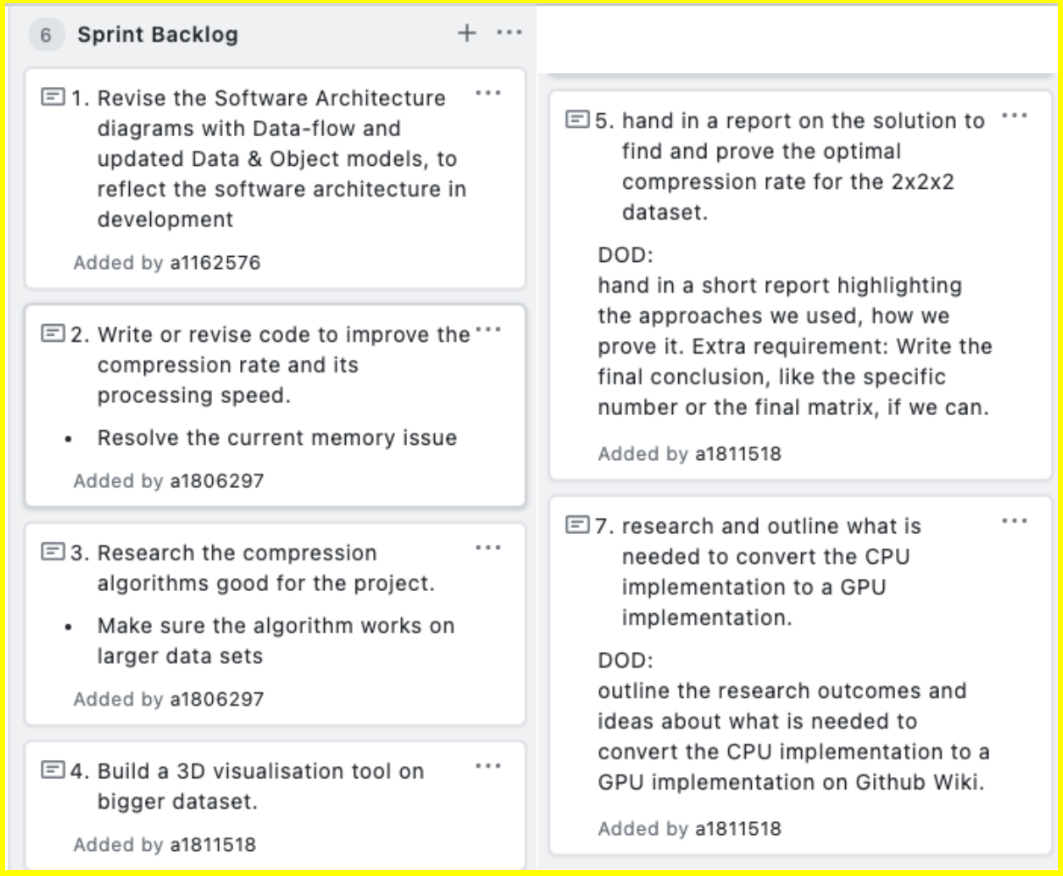

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outline the research outcomes and ideas about what is needed to convert the CPU implementation to a GPU implementation on Github Wiki.

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This week, there are both user stories rolled from the previous sprint and new user stories on the sprint backlog. We have four major goals in the next sprint: 1. Write or revise code to improve the compression rate and its processing speed, and **resolve the memory issue on the current algorithm**; 2. Develop a compression algorithm that can handle the big_one dataset; 3. Hand in a report on the solution to find and prove the optimal compression rate for the 2x2x2 dataset; 4. **research and outline what is needed to convert the CPU implementation to a GPU implementation**.

Since there are four main tasks, we should have a clear division of personnel and improve our communication in the next sprint.

Definition of Done

In the current phase:

- The code we develop is required to take standard input (strings of the form "x, y, z, x_size, y_size, z_size, 'domain'") and produce the result on standard output described in the project documentation.
- Either a .exe file or a Python script must be submitted to a verification service: MAPTEK TITAN.
- According to the user stories, we can submit our code once it improves the compression rate and processing speed, no matter how good they are.
- The datasets of input block models we implement must be comma-separated values (CSV) where each line encodes a block as a string of the form "x, y, z, x_size, y_size, z_size, 'domain'" and the code we develop is required to output a stream of the same format.
- The algorithm we develop must process a block model in slices of no more than parent block thickness at a time, rather than loading the entire input stream into memory first.
- All pull requests of code must be submitted on our GitHub repository, tested, and reviewed by two other team members (or one in the case of documentation/admin).
- The branches must pass the static code analysis before being merged. The Static Analysis ensures that the codes meet the PEP8 style standards (what all python code should aim for) and other issues such as unused variables and cyclomatic complexity. PEP8 is especially important for the developers because it mandates a set of conventions for things such as class/function names, spacing, and comment style. It allows all the developers to be able to read every developer's code in the same way.
- In the initialization implementation of the abstract classes of the model, we build the Model class. The Model is the internal representation of the block data model. The Model holds the current set of ParentBlocks which constitute the current slice of the model. The model also holds the mappings between domains and domain tags, which the Blocks use.
- In the initialization implementation of the abstract classes of the model, we build a ParentBlocks class. The ParentBlocks subdivide the model exactly with no remainder. Each Parent Block contains a collection of Blocks. Each Parent Block has a size and position. All of the Blocks that the Parent Block contains are positioned.

- relative to the ParentBlock position. The ParentBlock implements the iterator protocol, so can be iterated over natively in for loops.
- We also created the Block class in the abstraction part. This class describes a block, which has a size, a position relative to the start of its ParentBlock, and a domain tag.
- There is also a class method to combine all of those blocks and return them into a new block.
- We initialized the implementation of the modular compression system. All the compression algorithms are separated into modules. Each one takes as input a ParentBlock. The compression engine is responsible for delegating the compression to the various algorithms. The parent blocks are then written to the output.
- The Modular Architecture has been implemented, but it still needs to be tested with the runner.py in the Windows environment and then try to merge it.
- We also clarified some information in README, created requirements.txt, and configured flake8.
- We create wiki page to collect ideas about compression algorithms.
- We implement the base framework described in the System Architecture of the initial report.
- We extend the modular architecture (merged last week) to use multiprocessing.
- We add more methods for accessing the blocks within a parent block better.
- We add some descriptions of Algorithm ideas on wiki page.
- We clarify the aims for the next sprint after the client meeting.
- We implement the Multiprocessing as well as the Greedy-Expander Algorithm.
- For the task to improve the task board management: 1) add traceability between the sprint backlog and product backlog; 2) add the estimate of time and record the actual time on task board for comparison. 3) We add the deadline to the tasks.
- For the task to find the optimal compression algorithm: hand in a short report highlighting the approaches we used and how we prove it.
- For the GPU task: outline the research outcomes and ideas about what is needed to convert the CPU implementation to a GPU implementation on Github Wiki.

Summary of Changes:

Following changes happened since the last snapshot:

What we have done in this week

- We attended the sprint review and planning meeting and had a group meeting to discuss the division of personnel to fulfill the four goals for sprint 4;
- We submitted the new algorithm to Titan, and it passed the first three datasets;
- We updated the outline of how to get to the optimal compression algorithm for the 2x2x2 dataset on the GitHub wiki page.
- Yuanpeng has built a 3D visualisation tool that will work on small datasets;

changes on client requirements:

- The ultimate solution for the project is running on a GPU. We need to research and develop some ideas on how to convert our current algorithm from a CPU implementation to a GPU implementation.

Snapshot Week 10 of Group BLOCKS7PG

Product Backlog and Task Board

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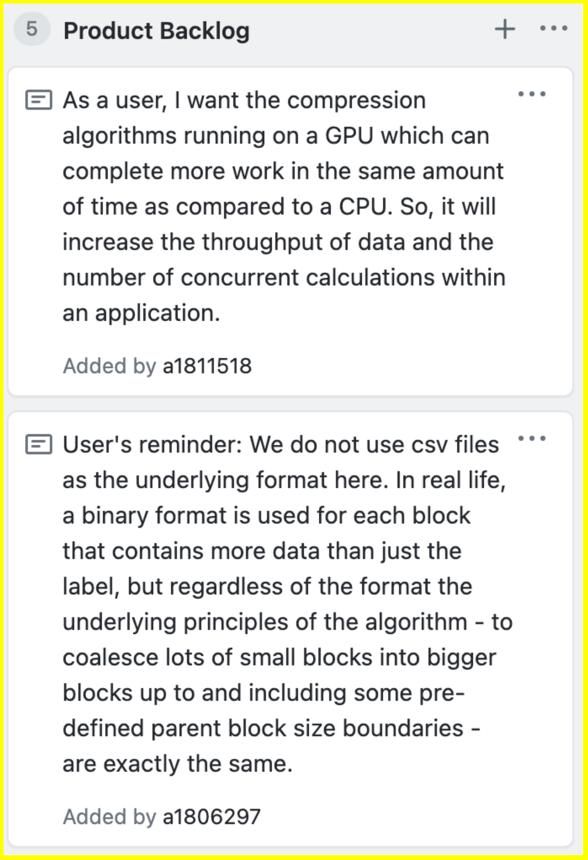

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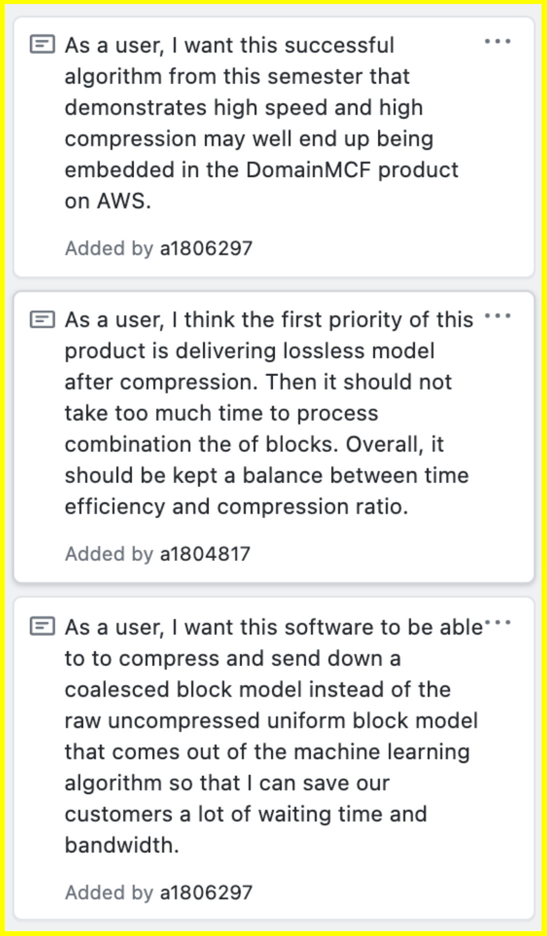

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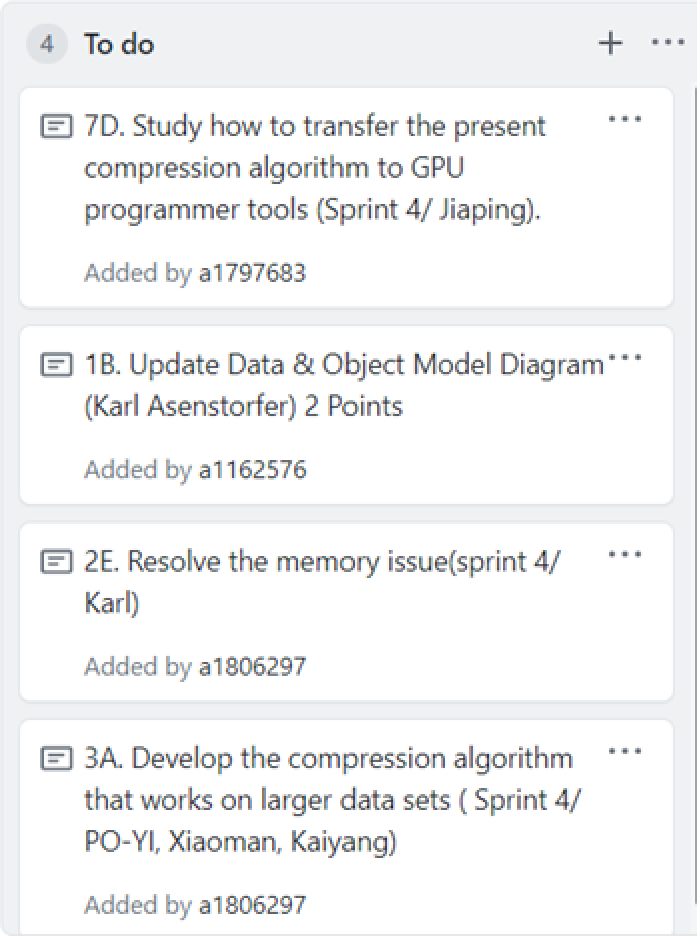

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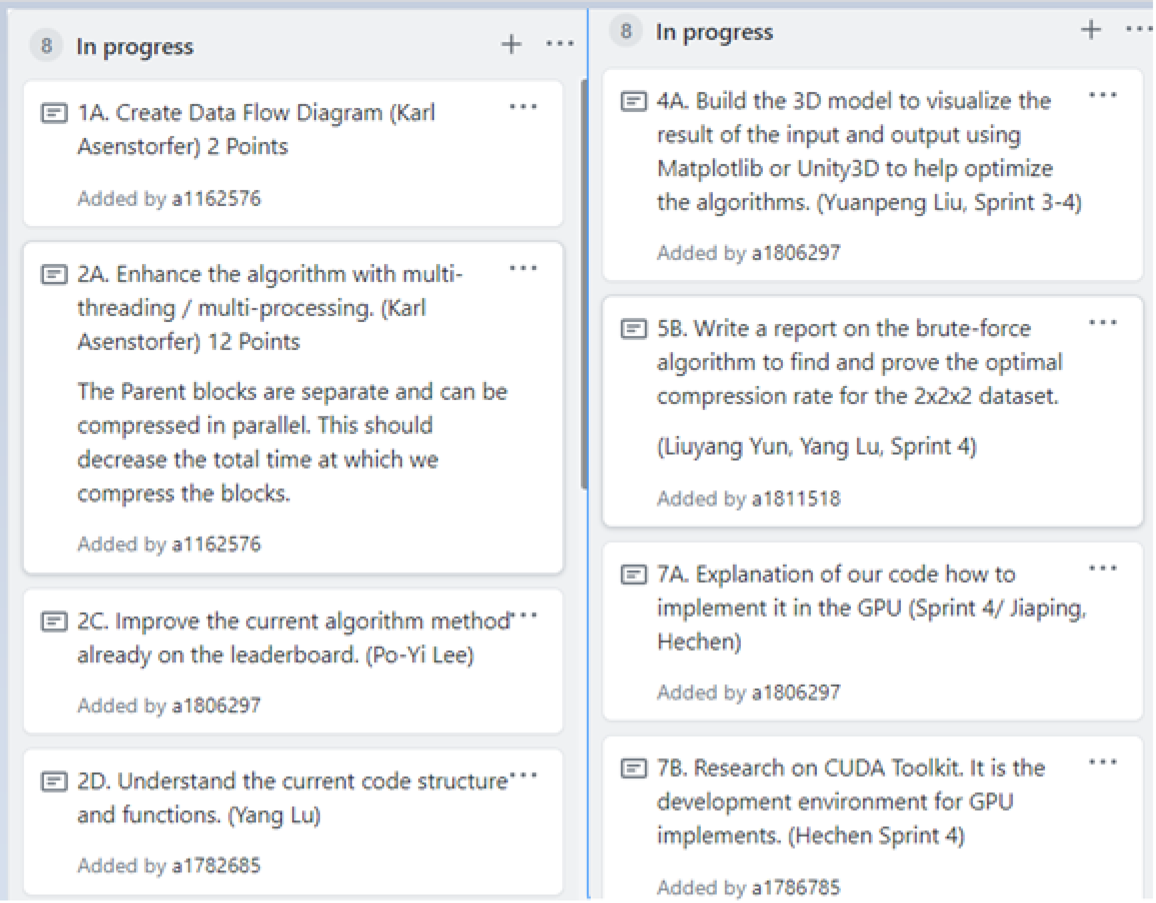

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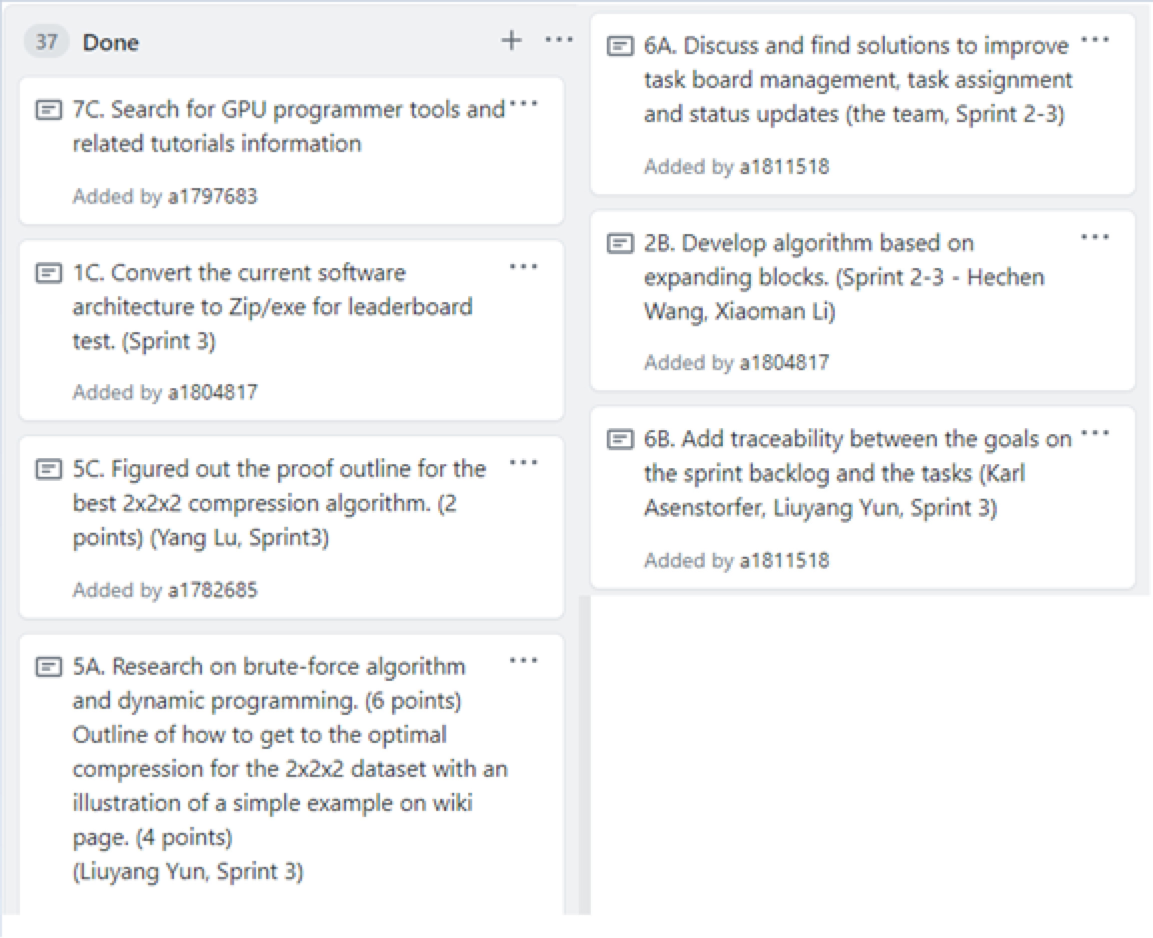

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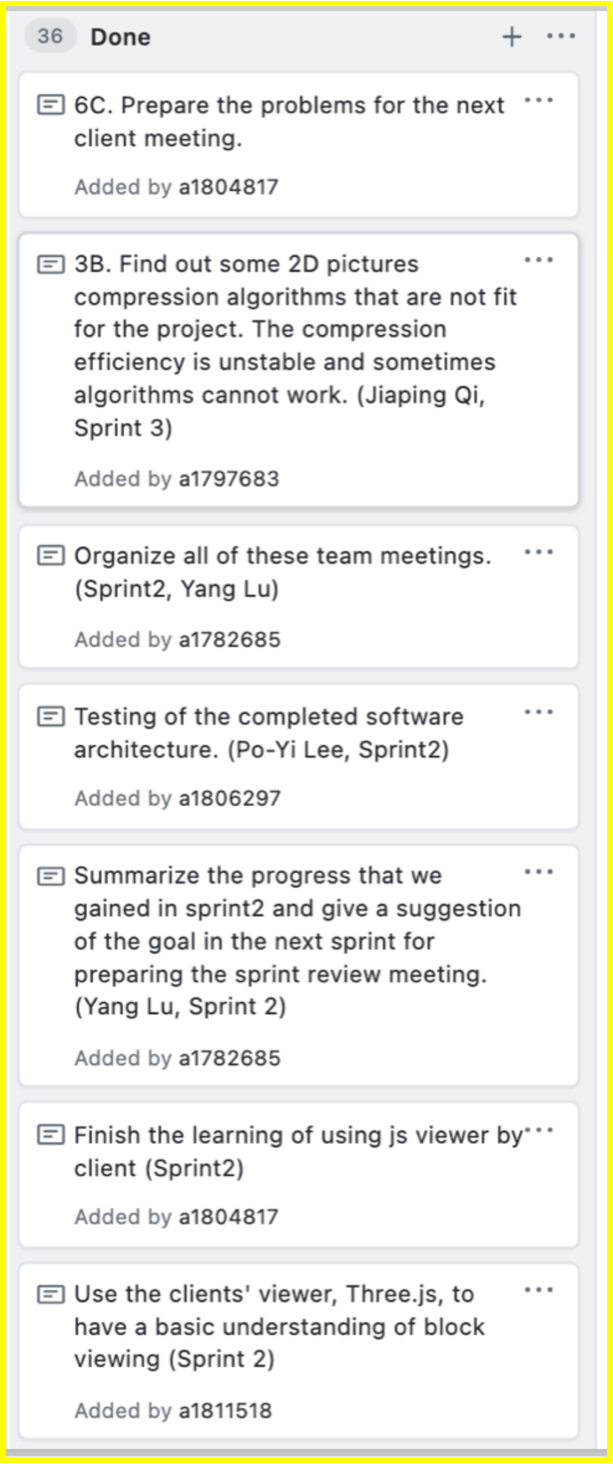

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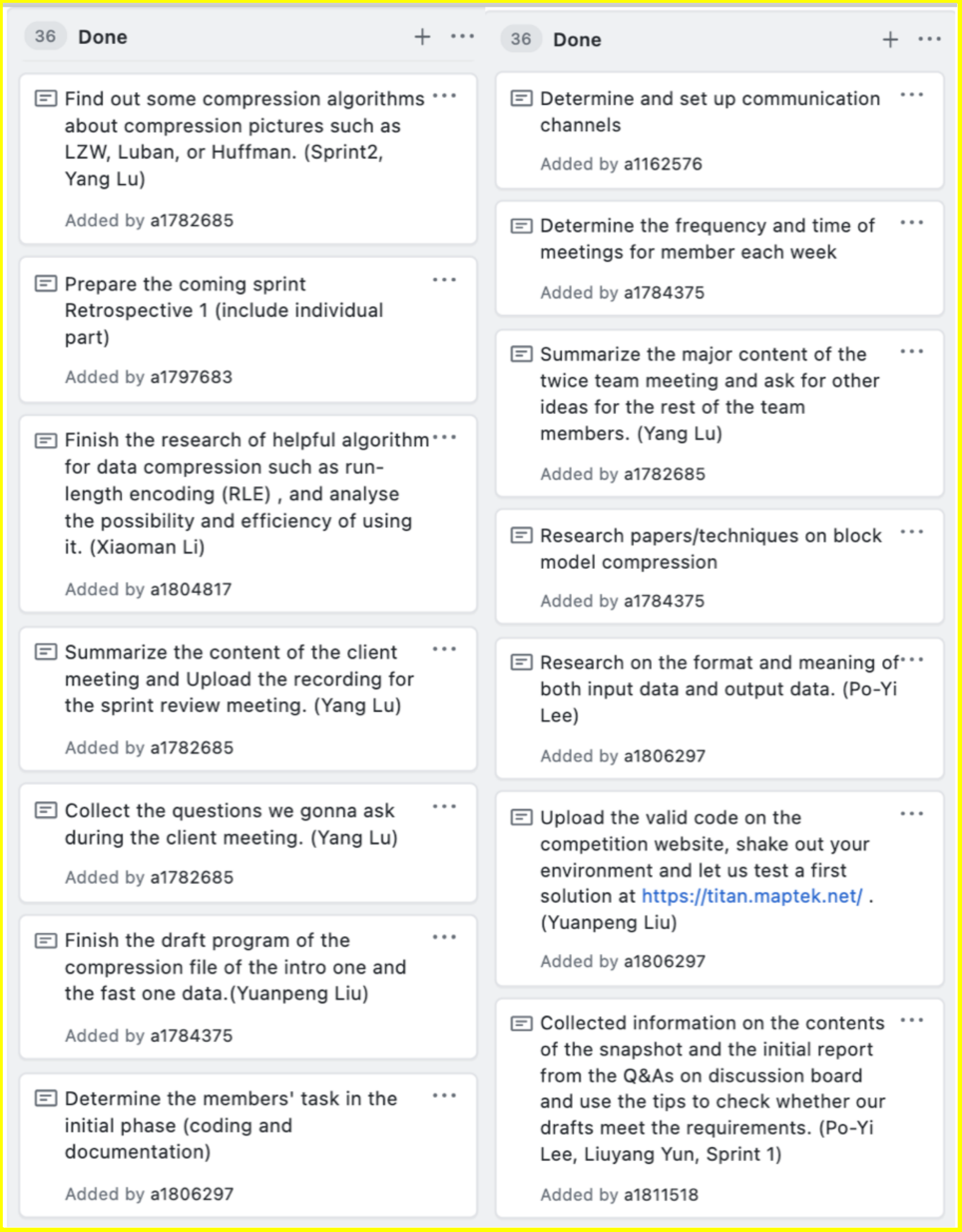

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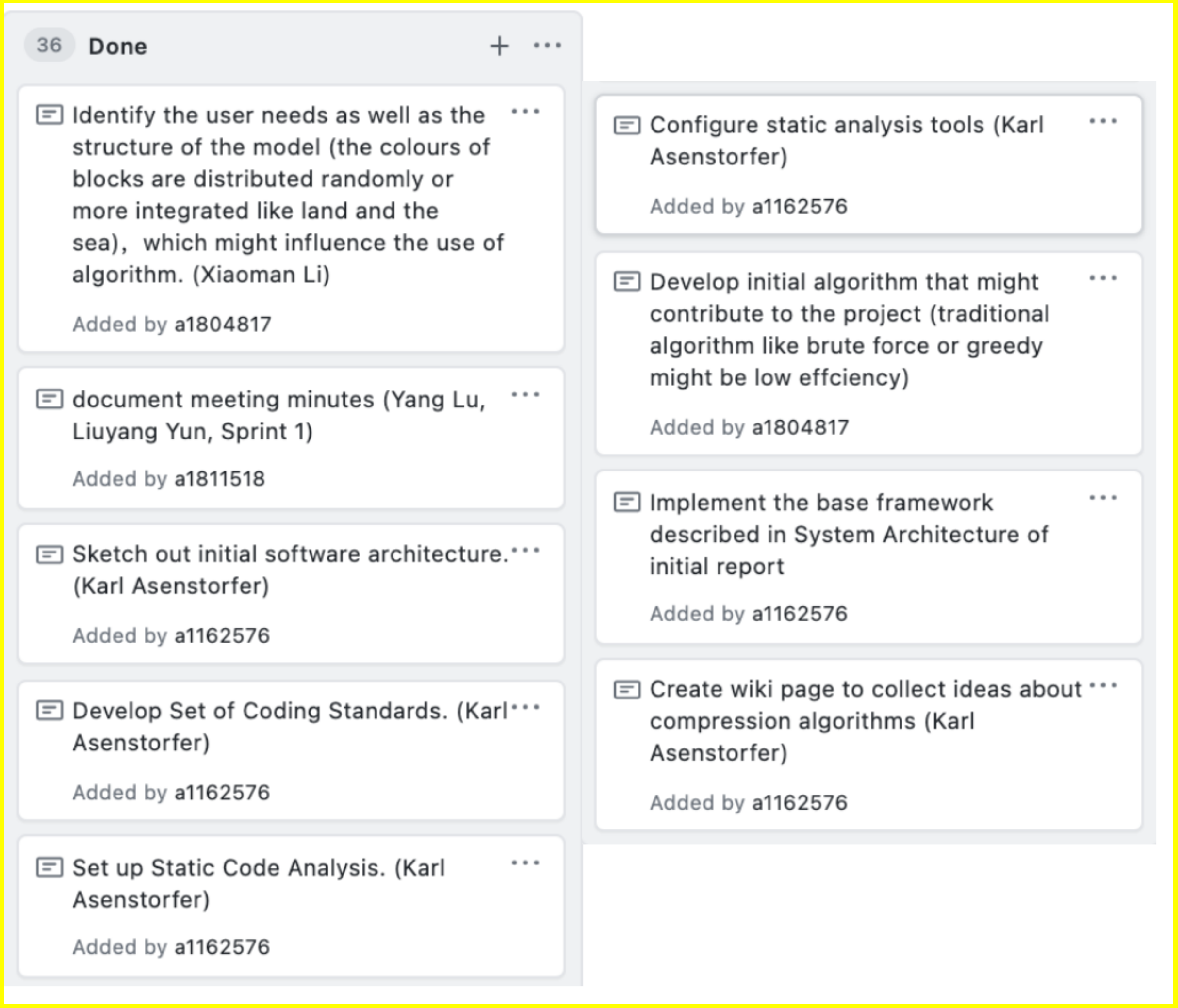

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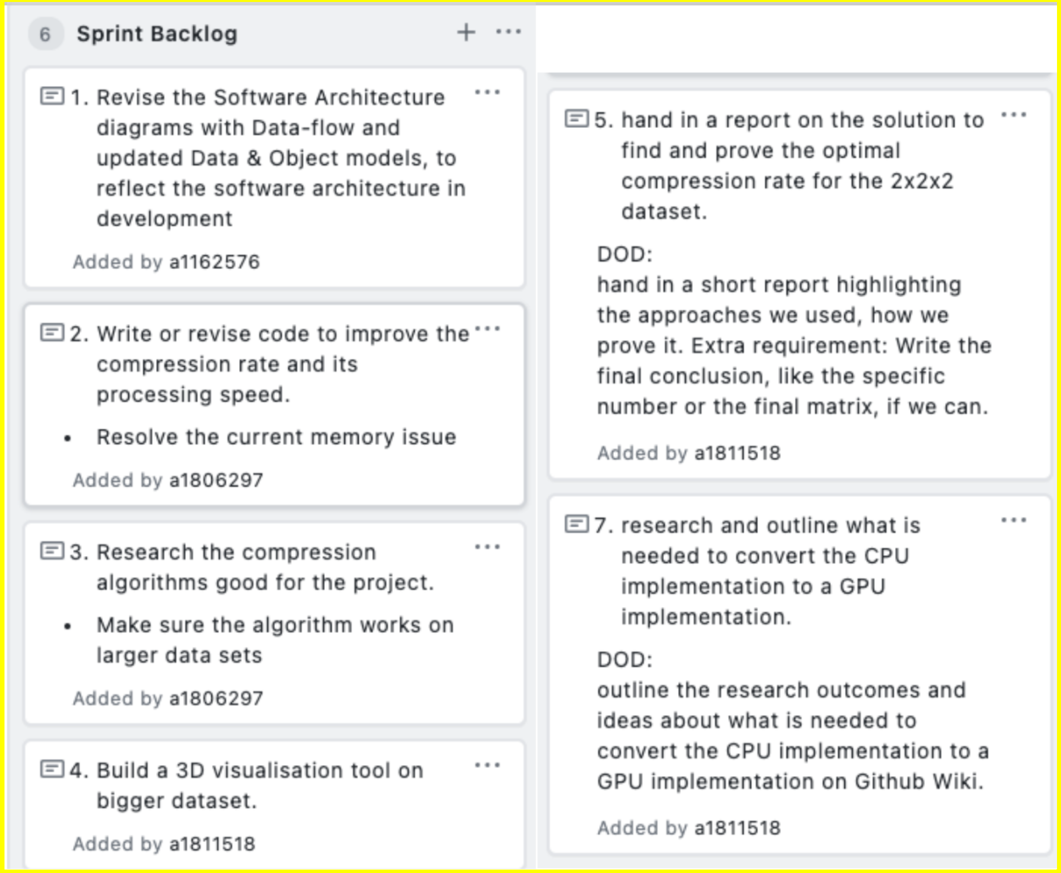

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For this week, there are no major changes to the Sprint Backlog and User Stories. The main tasks of our team at this stage include continuously improving our compression algorithm to enhance its compression rate and speed, handle the memory issue when compressing the huge dataset, and studying for the new issues our client raised about changing the compression implementation from CPU to GPU.

According to the discussion in the last meeting, we have managed to divide team members into four groups. All of the team members are working for their goals.

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- The algorithm we develop must process a block model in slices of no more than parent block thickness at a time, rather than loading the entire input stream into memory first.
- All pull requests of code must be submitted on our GitHub repository, tested, and reviewed by two other team members (or one in the case of documentation/admin).
- The branches must pass the static code analysis before being merged. The Static Analysis ensures that the codes meet the PEP8 style standards (what all python code should aim for) and other issues such as unused variables and cyclomatic complexity. PEP8 is especially important for the developers because it mandates a set of conventions for things such as class/function names, spacing, and comment style. It allows all the developers to be able to read every developer's code in the same way.
- In the initialization implementation of the abstract classes of the model, we build the Model class. The Model is the internal representation of the block data model. The Model holds the current set of ParentBlocks which constitute the current slice of the model. The model also holds the mappings between domains and domain tags, which the Blocks use.
- In the initialization implementation of the abstract classes of the model, we build a ParentBlocks class. The ParentBlocks subdivide the model exactly with no remainder. Each Parent Block contains a collection of Blocks. Each Parent Block has a size and position. All of the Blocks that the Parent Block contains are positioned.

- relative to the ParentBlock position. The ParentBlock implements the iterator protocol, so can be iterated over natively in for loops.
- We also created the Block class in the abstraction part. This class describes a block, which has a size, a position relative to the start of its ParentBlock, and a domain tag.
- There is also a class method to combine all of those blocks and return them into a new block.
- We initialized the implementation of the modular compression system. All the compression algorithms are separated into modules. Each one takes as input a ParentBlock. The compression engine is responsible for delegating the compression to the various algorithms. The parent blocks are then written to the output.
- The Modular Architecture has been implemented, but it still needs to be tested with the runner.py in the Windows environment and then try to merge it.
- We also clarified some information in README, created requirements.txt, and configured flake8.
- We create wiki page to collect ideas about compression algorithms.
- We implement the base framework described in the System Architecture of the initial report.
- We extend the modular architecture (merged last week) to use multiprocessing.
- We add more methods for accessing the blocks within a parent block better.
- We add some descriptions of Algorithm ideas on wiki page.
- We clarify the aims for the next sprint after the client meeting.
- We implement the Multiprocessing as well as the Greedy-Expander Algorithm.
- For the task to improve the task board management: 1) add traceability between the sprint backlog and product backlog; 2) add the estimate of time and record the actual time on task board for comparison. 3) We add the deadline to the tasks.
- For the task to find the optimal compression algorithm: hand in a short report highlighting the approaches we used and how we prove it.
- For the GPU task: outline the research outcomes and ideas about what is needed to convert the CPU implementation to a GPU implementation on Github Wiki.
- We clarify the team members’ division in the meeting.
- We add the visualization block to clarify the compression result.
- We add GPU programmer tools in the Github wiki.

Summary of Changes:

In this week, we mainly focused on the four goals we determined in the last meeting. The improving work continues. The compression rate for the 2*2*2 of the new architecture we upload can be 79.63% now and the 4*4*4 one can be 93.74%. The visualization function could help us with observing the compression result. According to that, the algorithm team could analyze the compression figure and do improving work. The proof of the optimal compression is still working. We have uploaded the brief outline of the proof to the Github wiki. The GPU team has finished the data preparation stage and is ready to work on implementing the algorithm on GPU programmer platforms.

Declaration:

I attended:

- the sprint 4 review and sprint 5 planning meeting on 22th October, 2021 with the tutors, Aryaman Dhawan and Will Reid.
- the sprint 4 retrospective meeting on 24th October, 2021 with the other team members.

What went well in the sprint:

In the sprint 4, we assigned four main tasks to each team member including writing or revising code to improve the compression rate and its processing speed, and resolve the memory issue on the current algorithm, developing a compression algorithm that can handle the big_one dataset, handing in a report on the solution to find and prove the optimal compression rate for the 2x2x2 dataset and researching what is needed to convert the CPU implementation to a GPU implementation in the sprint review and planning meeting and had a group meeting so that every sub-team have had their own meeting to discuss the progress and the methods to figure out their own task. In addition, we submitted the new algorithm to Titan which successfully passed the first three datasets. We also updated the outline of how to get to the optimal compression algorithm for the 2x2x2 dataset on the GitHub wiki page and waited for the tutor’s feedback. Yuanpeng has been working on a 3D visualisation tool that will work on bigger datasets.

What could be improved:

In the last sprint, the sub-team had their own meeting to discuss the progress and the methods to figure out their own task. However, each sub-team did not regularly update the team on what they have been discussing and any issues they've had twice per week no matter what they actually contribute to and the scrum master did not actually trace each team's progress. In the next spring, we could have the meeting more frequently for the team and have our own workshop twice a week to be able to trace the team's progress and achieve our goal more efficiently.

What will the group commit to improve in the next sprint:

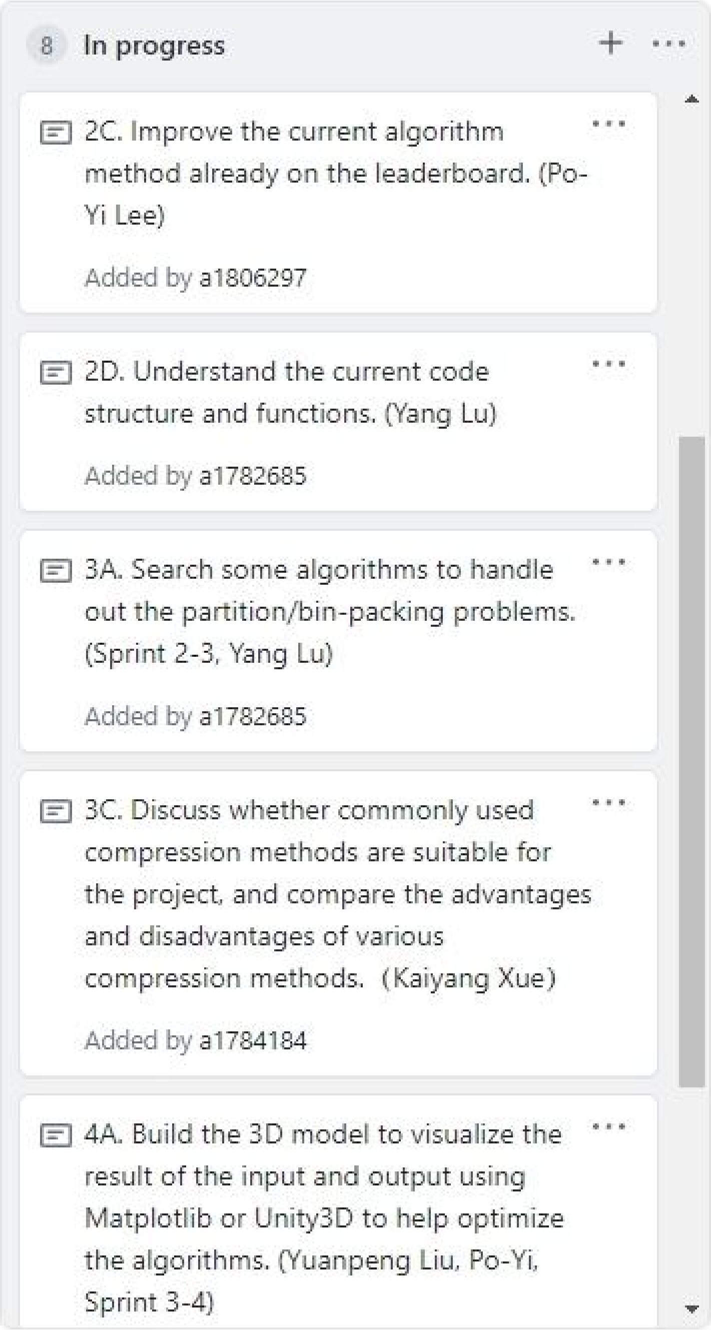
According to the sprint 4 retrospective meeting and the customer's requirement from the sprint 5 planning meeting, we will:

1. revise the software architecture diagrams with data-flow and updated data and object models to reflect the software architecture in development and to understand the architecture better for the team and the final report and presentation.
2. have the extra meeting joined by the members charged in the same task to not only discuss revising the existing code but also research the new compression algorithms in order to improve the compression rate and its processing speed.
3. build the 3D model visualization which can be used on a bigger size of dataset by testing the visualization tool with different dataset.
4. do the research on how to implement our code from CPU to GPU to satisfy the customer's requirement.
5. Complete the final report and final presentation in the next sprint.

Comment on your progress this sprint:

My in-progress tasks:

- Build the 3D model to visualize the result of the input and output using Matplotlib or Unity to help optimize the algorithms
- Manage to Improve the current algorithm method already on the leaderboard.



8 In progress

2C. Improve the current algorithm method already on the leaderboard. (Po-Yi Lee)

Added by a1806297

2D. Understand the current code structure and functions. (Yang Lu)

Added by a1782685

3A. Search some algorithms to handle out the partition/bin-packing problems. (Sprint 2-3, Yang Lu)

Added by a1782685

3C. Discuss whether commonly used compression methods are suitable for the project, and compare the advantages and disadvantages of various compression methods. (Kaiyang Xue)

Added by a1784184

4A. Build the 3D model to visualize the result of the input and output using Matplotlib or Unity3D to help optimize the algorithms. (Yuanpeng Liu, Po-Yi, Sprint 3-4)

Figure 1: My in-progress tasks

In this sprint, I have been also revising the original compression algorithms and finding the optimal one with the multiprocessing system to develop better compression methods. In addition, the visualization model of compressed block using Unity is still in progress because we are still trying to figure out how to implement the visualization model on a bigger size of dataset.

Requirements Changes:

According to the customer's requirement for the next sprint, a new competition has been released and it includes the new dataset the_worldly_one_16777216_256x256x256, a ~16 million block model of the entire earth. Since the size of the blocks is the same as the size of the entire model(x_count, y_count, z_count, parent_x, parent_y and parent_z are 256), we can consider the entire model as a single parent block. Therefore we should revise the code and change the way of reading the parent block because there was a value error called "chunksize must be >= 1" when I initially implemented our algorithm with our multiprocessing method.