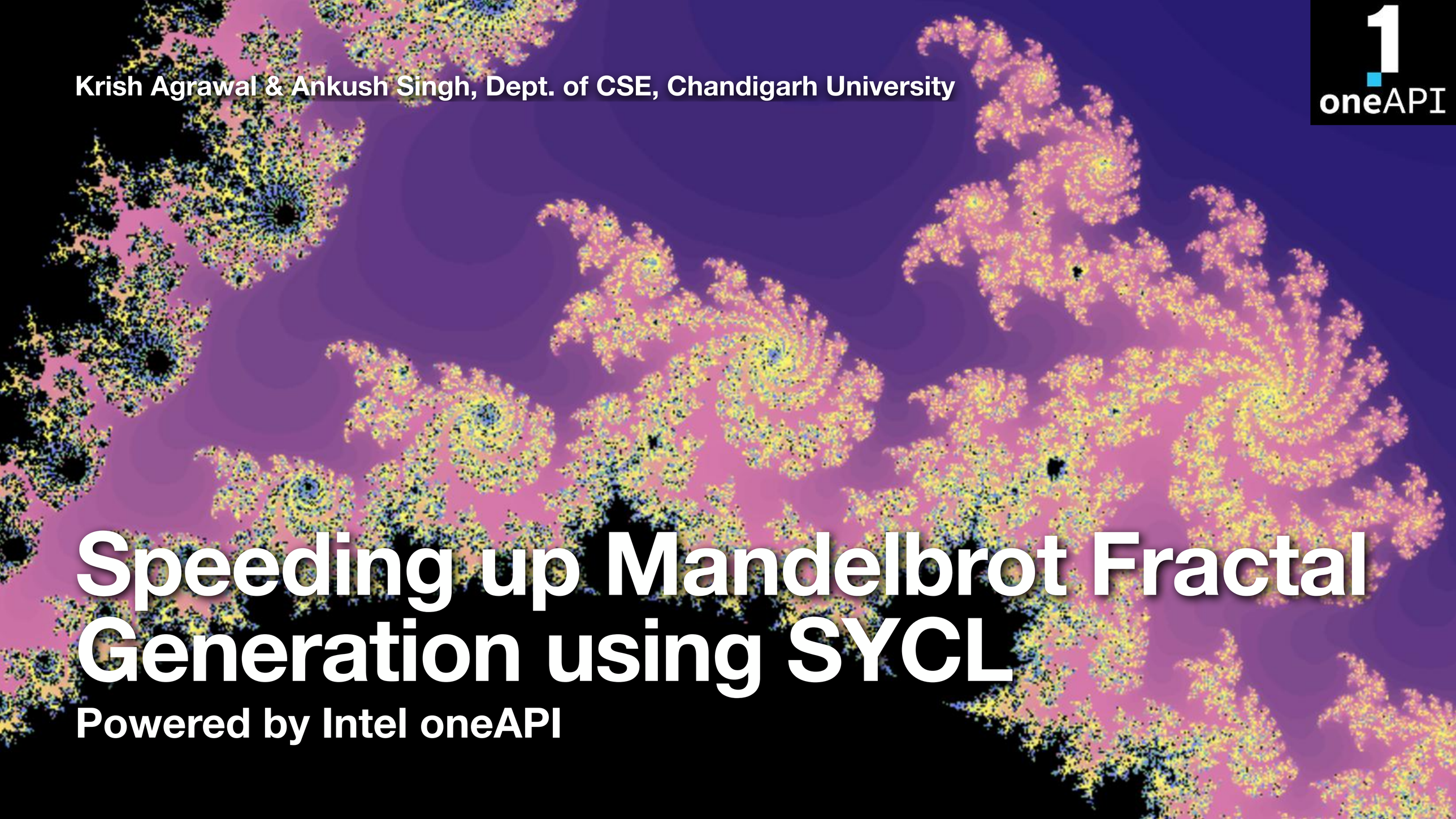
Krish Agrawal & Ankush Singh, Dept. of CSE, Chandigarh University

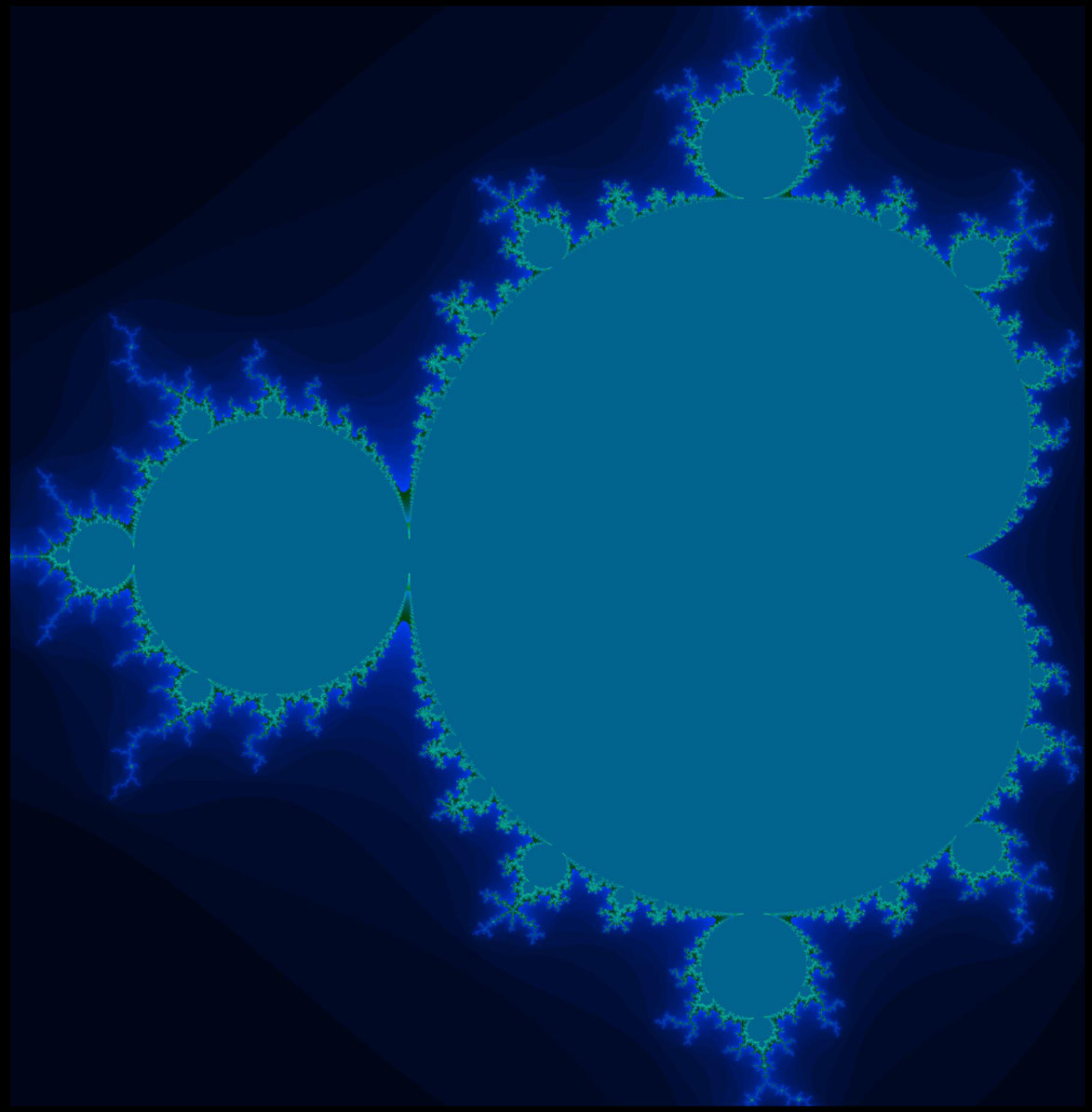


Speeding up Mandelbrot Fractal Generation using SYCL

Powered by Intel oneAPI

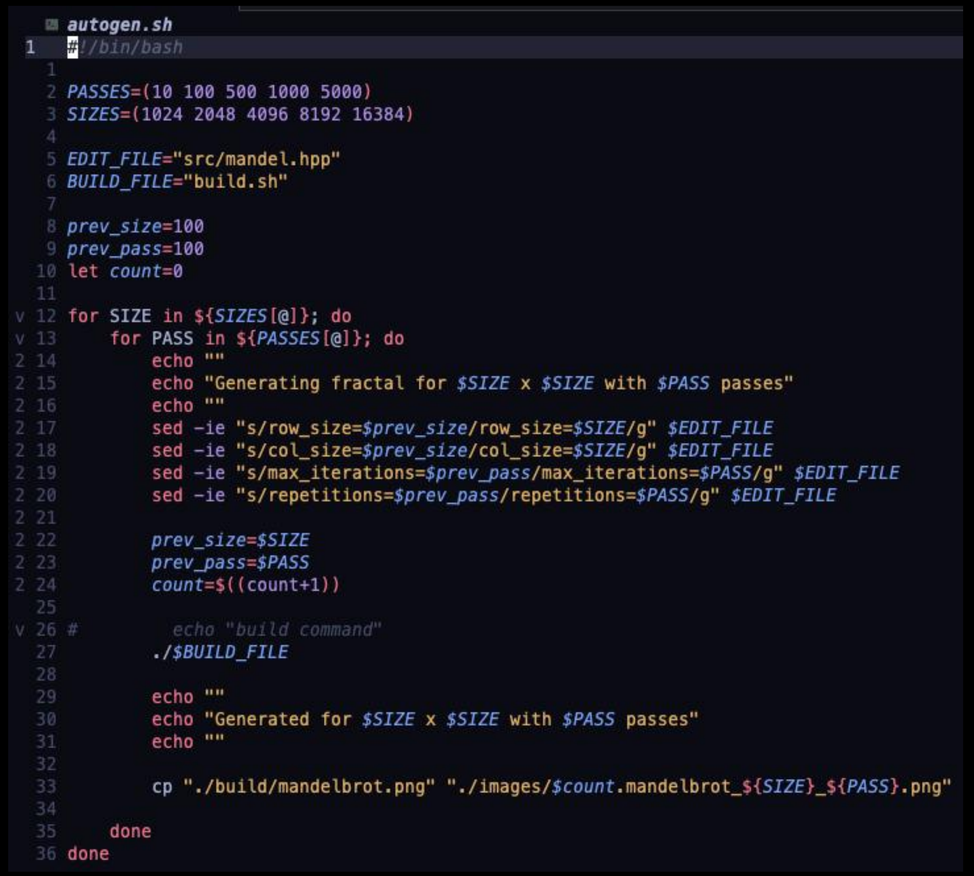
What are Fractals?

- Fractals are complex shapes or patterns that repeat themselves at different scales.
- The Mandelbrot set is a specific type of fractal that is created through a mathematical formula. It is named after Benoit Mandelbrot, who discovered it in the 1970s.



What did we do?

- We took the Mandelbrot sample from the listed samples in the VPS and adjusted the image resolution and the number of iterations for the fractal generations.
- We also wrote Bash Script to automate the generation of multiple images from a range of sizes and iterations.
- With this, we discovered the capabilities of the SYCL and its relation with the Intel GPU to decrease the processing time Vanilla C++.

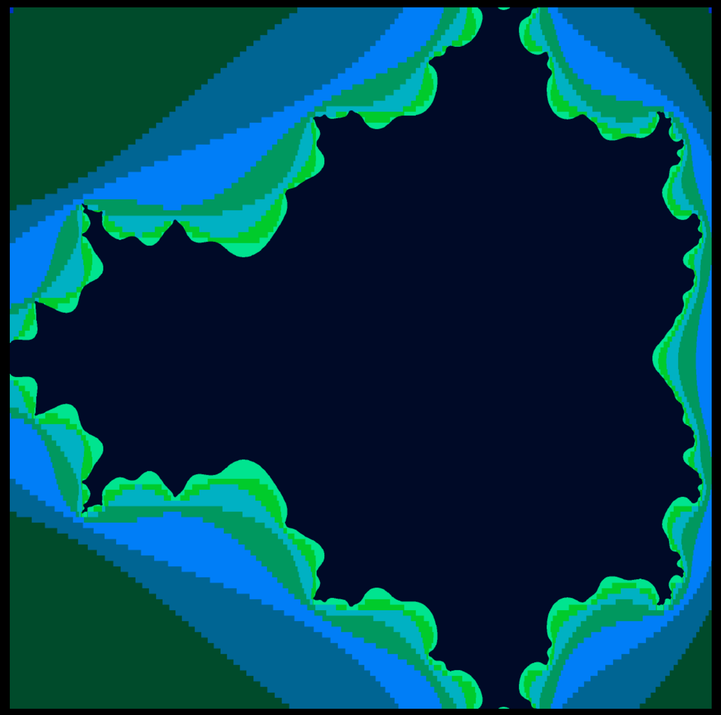


autogen.sh

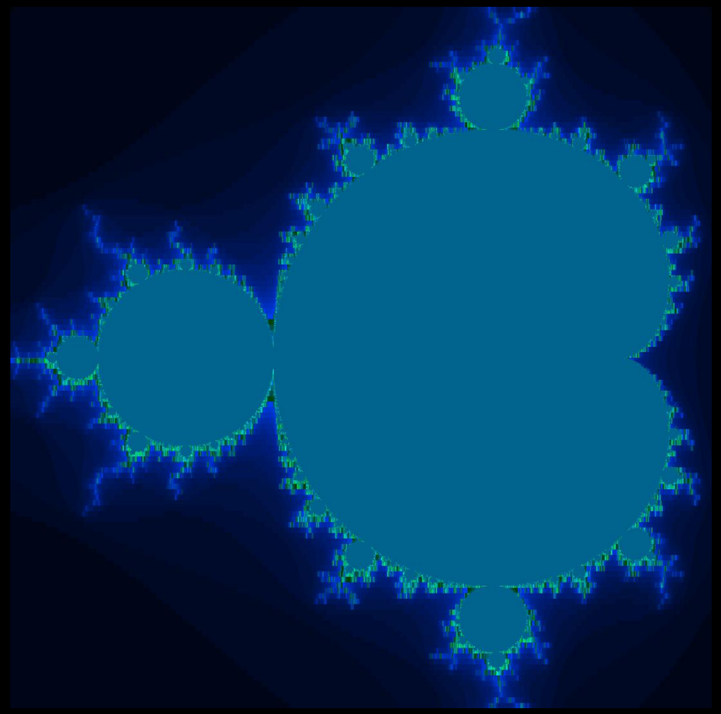
```
#!/bin/bash

PASSES=(10 100 500 1000 5000)
SIZES=(1024 2048 4096 8192 16384)

EDIT_FILE="src/mandel.hpp"
BUILD_FILE="build.sh"

prev_size=100
prev_pass=100
let count=0

for SIZE in ${SIZES[@]}; do
    for PASS in ${PASSES[@]}; do
        echo ""
        echo "Generating fractal for $SIZE x $SIZE with $PASS passes"
        echo ""
        sed -ie "s/row_size=$prev_size/row_size=$SIZE/g" $EDIT_FILE
        sed -ie "s/col_size=$prev_size/col_size=$SIZE/g" $EDIT_FILE
        sed -ie "s/max_iterations=$prev_pass/max_iterations=$PASS/g" $EDIT_FILE
        sed -ie "s/repetitions=$prev_pass/repetitions=$PASS/g" $EDIT_FILE

        prev_size=$SIZE
        prev_pass=$PASS
        count=$((count+1))

#         echo "build command"
        ./$BUILD_FILE

        echo ""
        echo "Generated for $SIZE x $SIZE with $PASS passes"
        echo ""

        cp "./build/mandelbrot.png" "./images/$count.mandelbrot_${SIZE}_${PASS}.png"

    done
done
```

Results

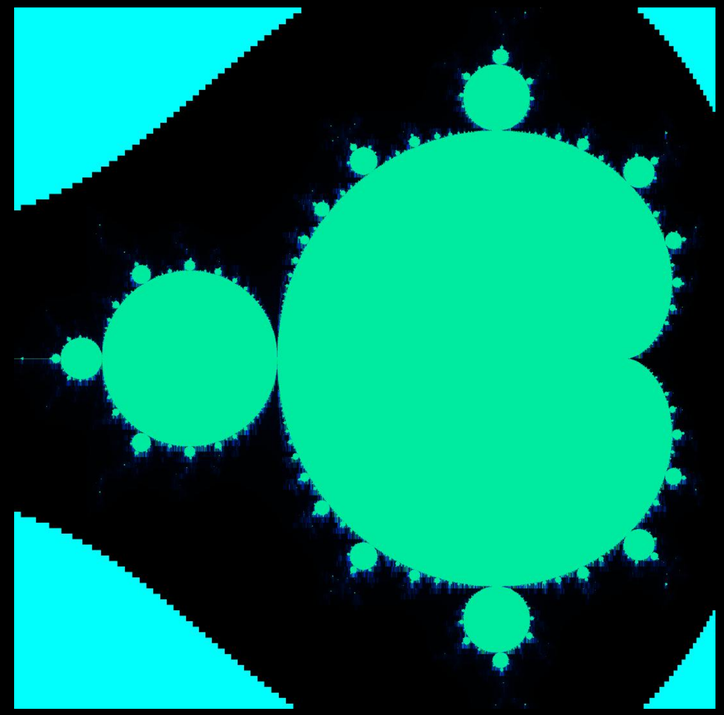
Image Resolution - 2048p



10 iterations

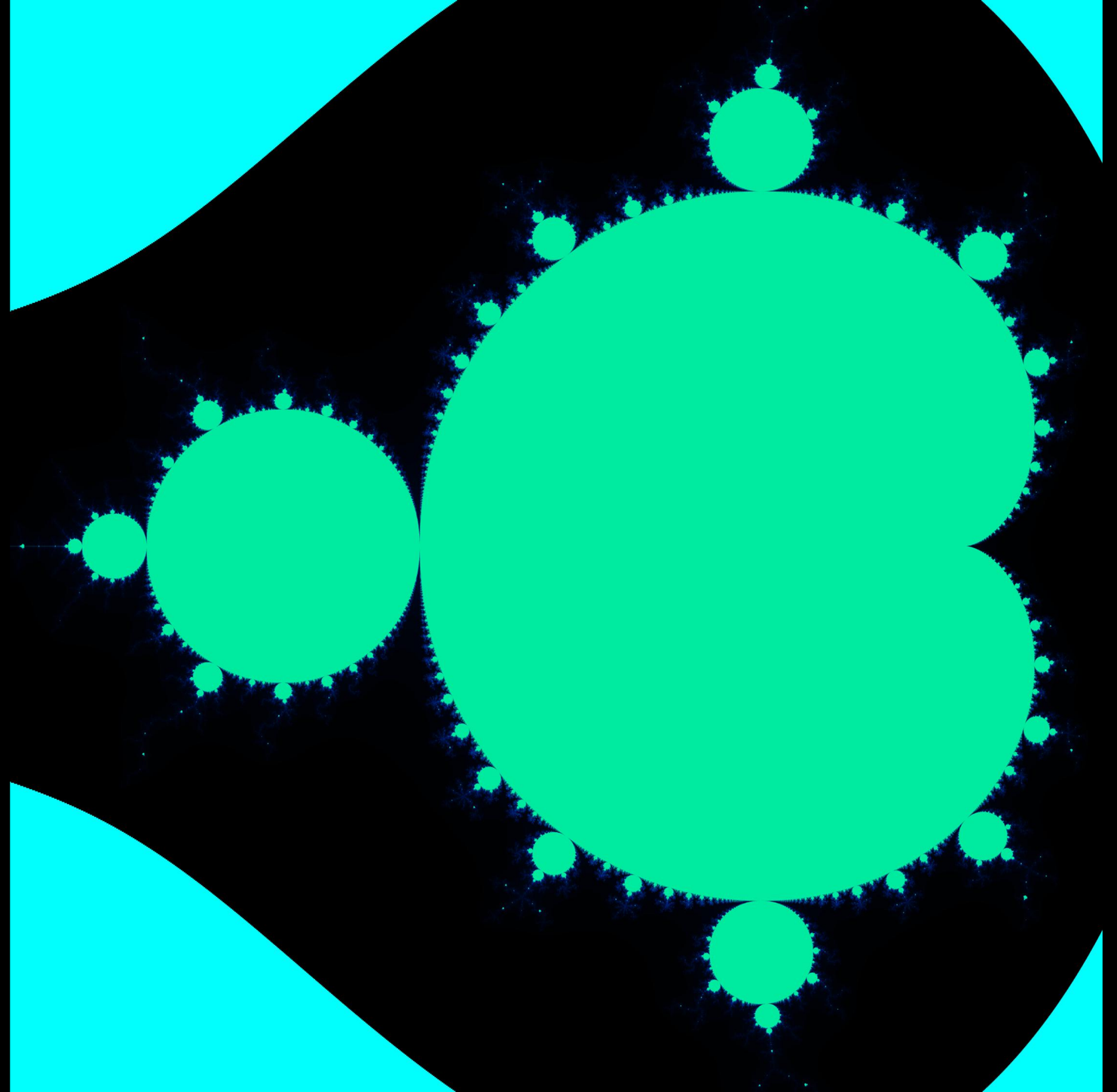


100 iterations



1000 iterations

16K Resolution
with 1000 iterations



Github Repo

https://github.com/kragrrr/intel-oneAPI-hackathon

Developed by :
Krish Agrawal (@kragrrr)
Ankush Singh (@ankushKun)