Automated Dataflow System for DNA Amplification and Diagnostics

Overview
Real-time PCR is an upcoming disease diagnostic tool. However, current limitations include high error output and a risk of incorrect diagnosis. Error arises because the input for real-time PCR includes extensive settings and the output contains large amounts of data. For countries like China, with a large population and small doctor-to-patient ratio, there is a pressing need for a more efficient, accurate, and user-friendly system.

Objectives
The goal of this project was to create a software program that automated dataflow from nucleic acid extraction to diagnoses. This involved automatically sending data to and controlling the real-time PCR instrument, accurately analysing PCR results, and outputting results via data table and graphical user interface (GUI) which interactively displays information for an easy disease diagnosis.

Approach
• Gathered customer needs and requirements from Liferiver sponsor and SJTU teammates
• Determined steps to calculate cycle threshold (Ct) values to properly create program
• Researched patents of algorithms to calculate the baseline and threshold
• Concept generation and selection to determine most accurate algorithm
• Benchmarked ideas with sponsor and SJTU teammates
• Program coding and testing with raw data
• Comparing standard curves to determine best program
• Collaborating programs with SJTU teammates
• Modifying code to best meet project objectives

Outcomes
• This program lessens the amount of user input required, thus reducing the error resulting from incorrect input
• The program identifies samples with no significant amplification thereby reducing occurrences of false positives
• Output includes a data table and GUI which allows for easier diagnosis
• With a standard curve coefficient of determination ($R^2$) less than the existing program the new program is less accurate in using Ct value to determine a sample’s initial concentration of target DNA