

# Optimization of Real Time ddPCR using Deep Learning

A presentation template

FirstName LastName  
Sharif University of Technology  
[author@email.com](mailto:author@email.com)



## **1** Introduction

- PCR
- Literature Review

## **2** Current Status

- Optical Subsystem
- Computational Subsystem

## **3** Future Steps

## **4** Conclusion



# What is PCR

- Polymerase Chain Reaction is a chemical reaction widely used for creating copies from a specific DNA sequence for diagnosis and forensic applications.



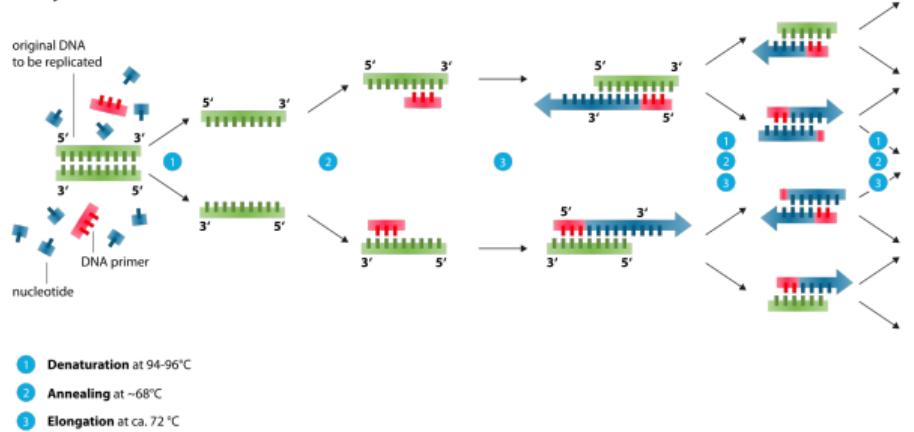
IAEA Bulletin, Infectious Diseases, June 2020



# PCR Cycle

- 1 Denaturation in  $90^{\circ}\text{C} - 95^{\circ}\text{C}$
- 2 Annealing in  $65^{\circ}\text{C} - 68^{\circ}\text{C}$
- 3 Extension in  $72^{\circ}\text{C}$

Polymerase chain reaction - PCR



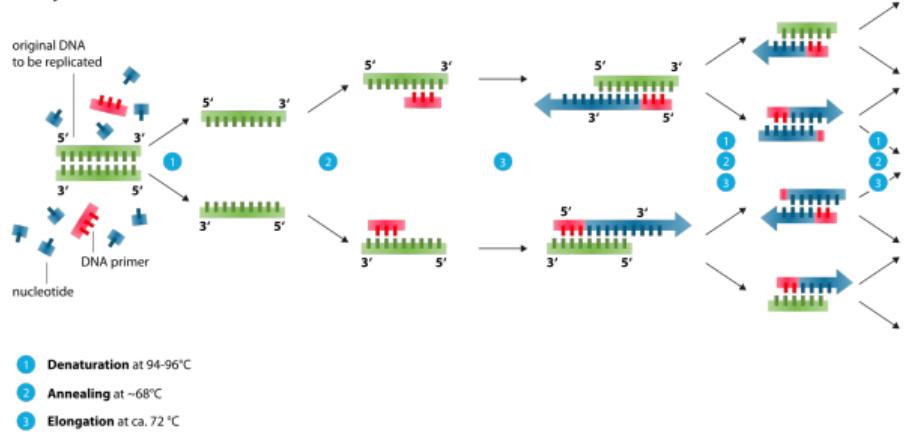
Polymerase Chain Reaction (PCR): Steps, Types, Applications, Microbeonline, 2021



# PCR Cycle

- 1 Denaturation in  $90^{\circ}\text{C} - 95^{\circ}\text{C}$
- 2 Annealing in  $65^{\circ}\text{C} - 68^{\circ}\text{C}$
- 3 Extension in  $72^{\circ}\text{C}$

Polymerase chain reaction - PCR



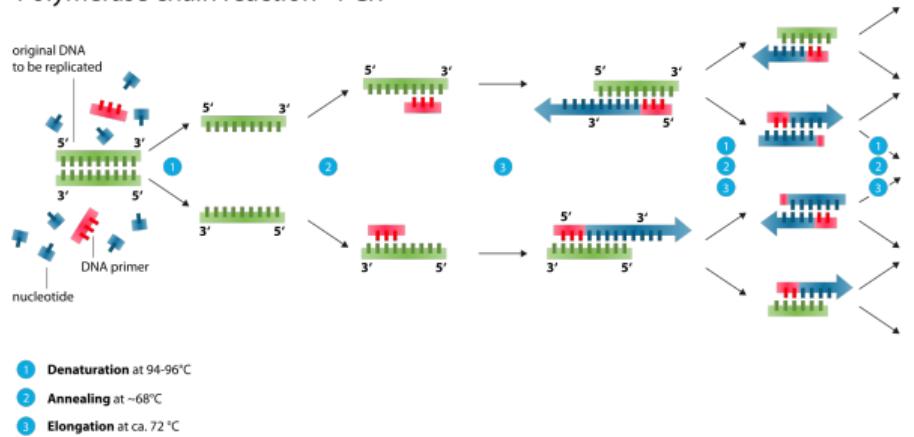
Polymerase Chain Reaction (PCR): Steps, Types, Applications, Microbeonline, 2021



# PCR Cycle

- 1 Denaturation in  $90^{\circ}\text{C} - 95^{\circ}\text{C}$
- 2 Annealing in  $65^{\circ}\text{C} - 68^{\circ}\text{C}$
- 3 Extension in  $72^{\circ}\text{C}$

Polymerase chain reaction - PCR

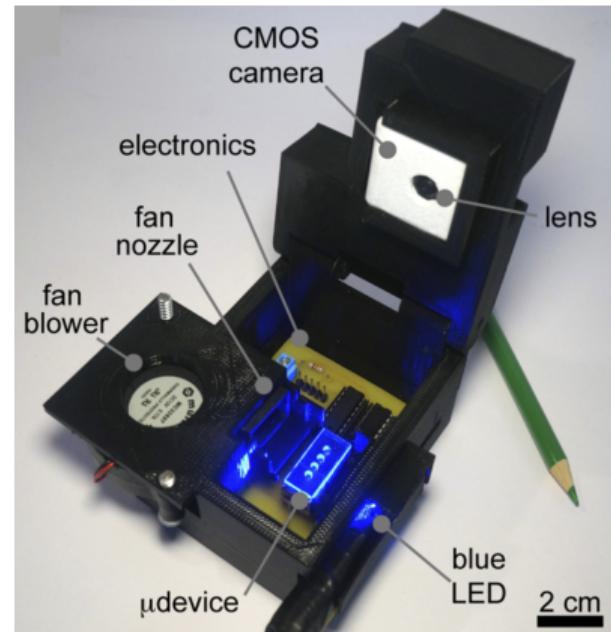


Polymerase Chain Reaction (PCR): Steps, Types, Applications, Microbeonline, 2021



# Low Cost PCR device

- There has been many efforts on creating Low-Cost PCR device. Most of them only supported low number of reaction chambers (4 to 8) due to their small size.



Mendoza et al., Analytical Chemistry, 2018



# Low Cost PCR device

- There have been novel ideas to make it cost even less!



Chan et al., Plos One, 2016



# PCR analysis and ML

- ML has been used for designing the primers, predicting the result of a PCR reaction and etc.
- Most of the packages have been written using R programming language



# Future Steps

- 1 Completely Implementing the New Optical Subsystem.
- 2 Real-Time File Transfer and Processing using Wireless Connections.
- 3 Running more tests to obtain data.
- 4 Implement ML algorithms to Image Processing and Temperature Control Subsystems .



# Conclusion

- Basics of PCR process was described.
- A brief literature review on the subject.
- Progress made on Optical Subsystem and Computational Subsystem reported.
- Future roadmap explained.



# References I

-  **Mendoza-Gallegos et al.**  
*An affordable and portable thermocycler for real-time PCR made of 3D-printed parts and off-the-shelf electronics.*  
Analytical chemistry, 2018
-  **Chan et al.**  
*A Rapid and Low-Cost PCR Thermal Cycler for Infectious Disease Diagnostics.*  
PLOS ONE, 2016
-  **Nicole Jawerth**  
*How is the COVID-19 virus detected using real time RT-PCR?*  
IAEA Bulletin, 2020
-  **Acharya Tankeshwar**  
*Polymerase Chain Reaction (PCR): Steps, Types, Applications.*  
Microbe Online, 2021

