



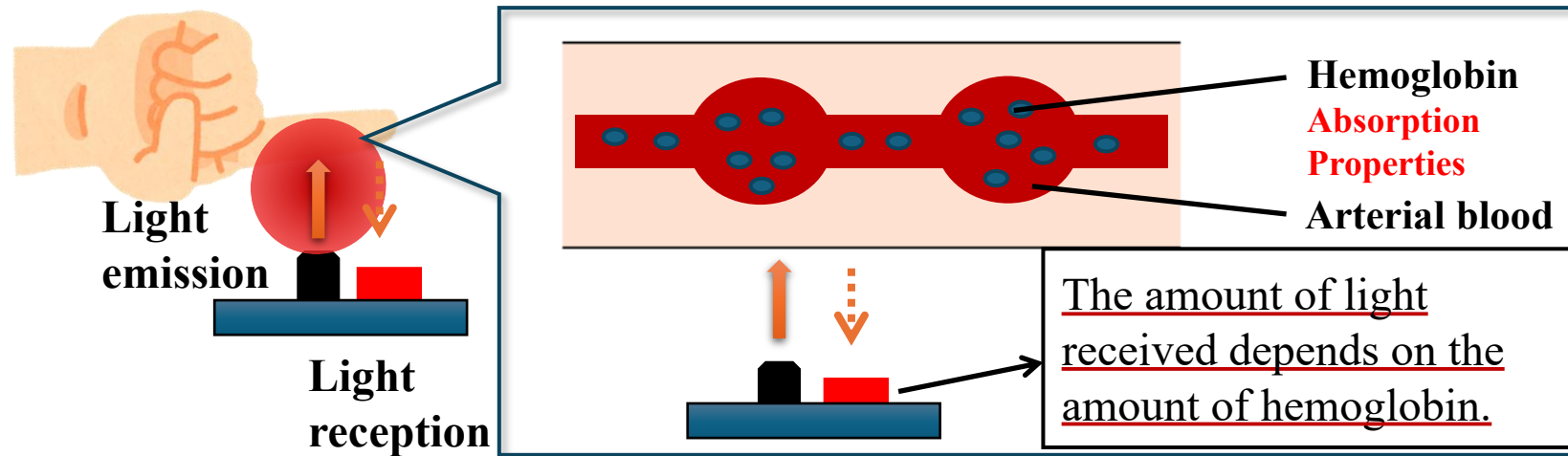
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SpO₂ estimation using web-Camera

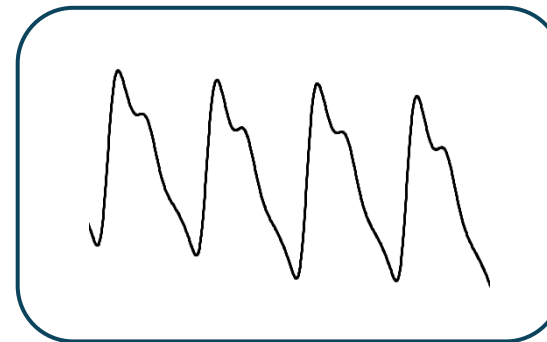
rPPG (Remote Photoplethysmography)

PPG is a method that uses the light-absorbing properties of hemoglobin to measure changes in blood vessel volume. Specifically, the method using a camera is called rPPG.

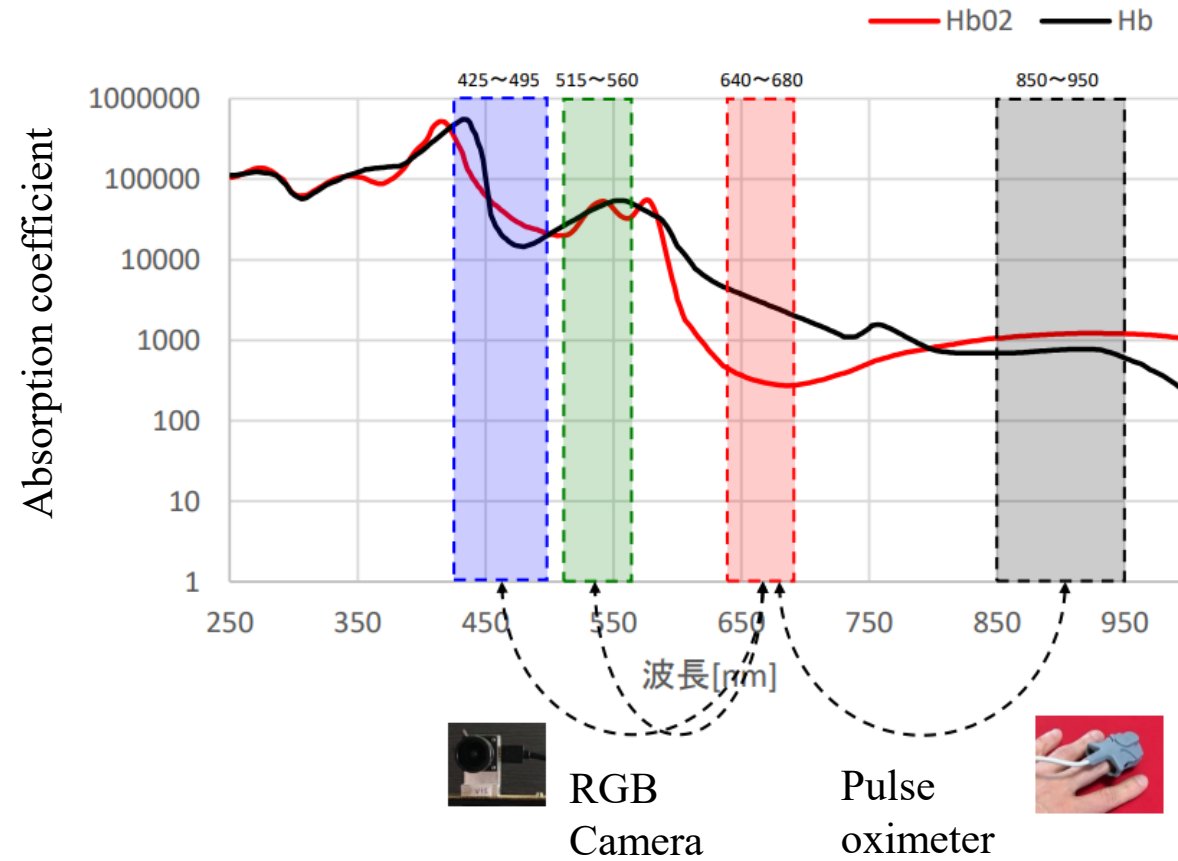


Measure:

- heart rate,
 - respiratory rate,
 - blood oxygen saturation (SpO₂),
- and more.



- SpO2 can be measured by comparing two light sources with different wavelengths.



- Traditionally, SpO2 is estimated from the difference in absorption coefficients using red and infrared light sources, but in the case of cameras, infrared light is replaced with green or blue light sources.

SpO ₂	Red	Green	Blue
			
			

$$X = \frac{AC_{\lambda_1}/DC_{\lambda_1}}{AC_{\lambda_2}/DC_{\lambda_2}}$$

$$SpO_2 = a \cdot X + b$$

λ_1 : Red

λ_2 : Green, Blue

AC : Pulse wave amplitude value determined by blood hemoglobin level
 DC : A constant value representing the intensity of the irradiated light.



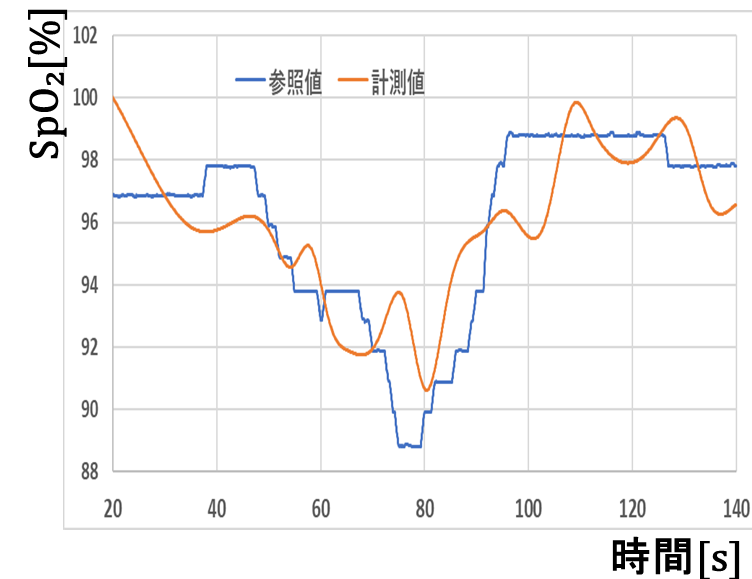
$$X = \frac{AC_{\lambda_R}/DC_{\lambda_R}}{AC_{\lambda_G}/DC_{\lambda_G}} \rightarrow SpO_2 = \alpha + \gamma X$$

AC...rPPG Amplitude

DC...rPPG Offset

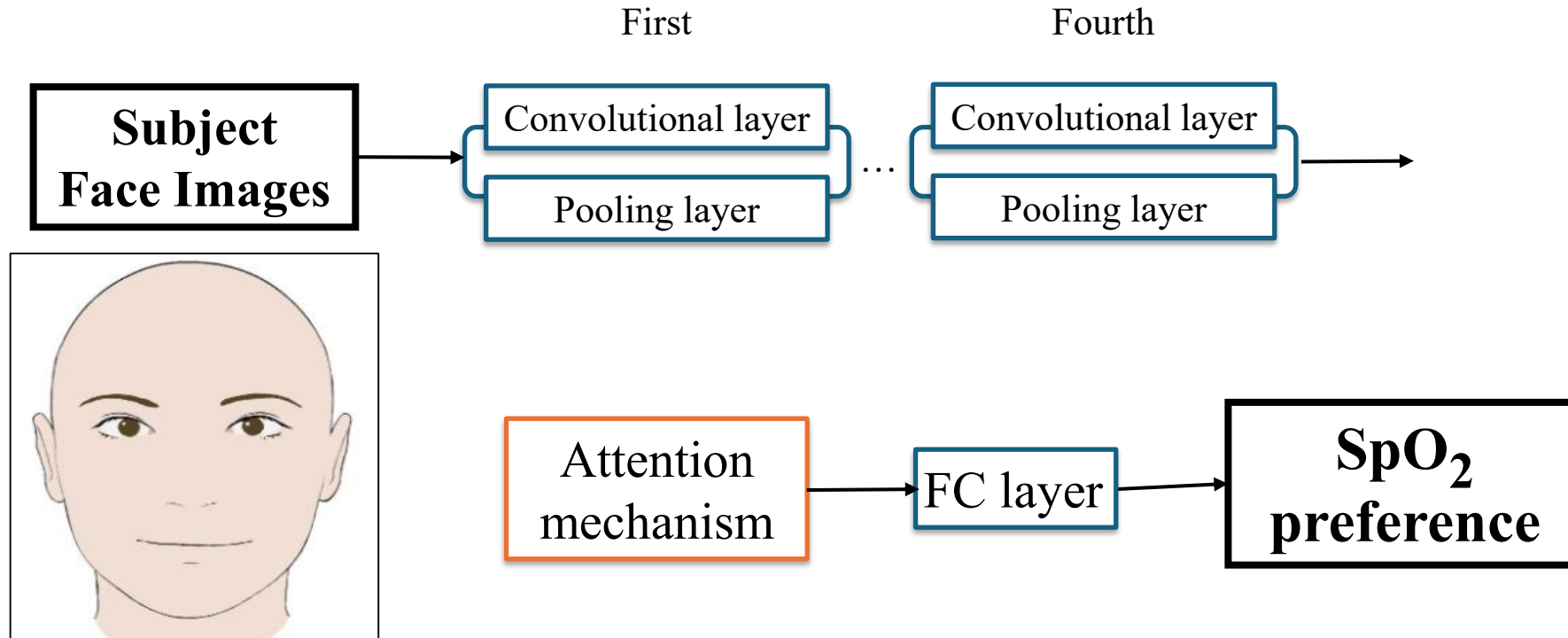
α, γ represent a coefficient obtained empirically from calibration.

RMSE:1.79 CC:0.79



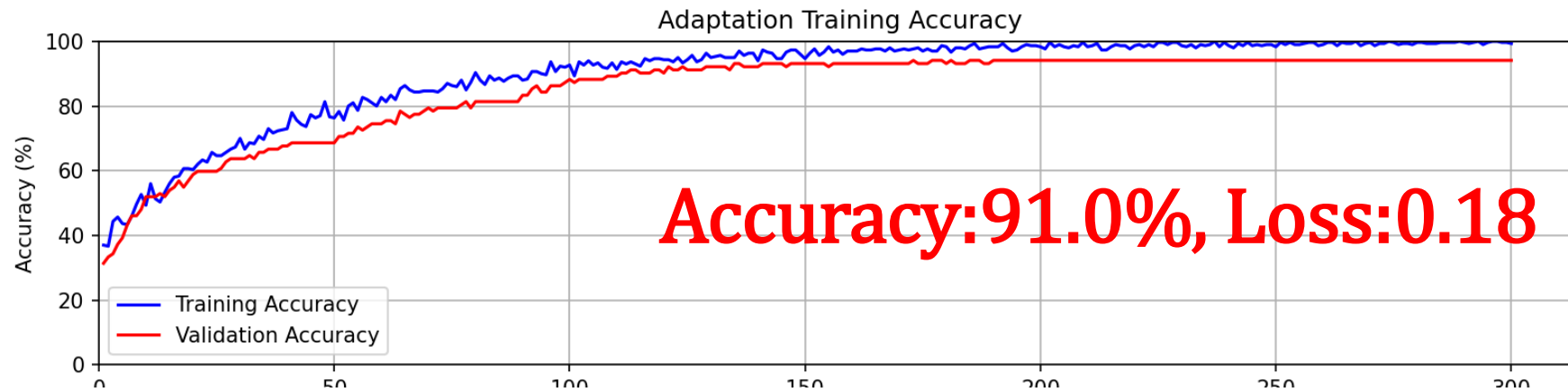
The low sampling rate and SNR make it difficult to calculate the amplitude ratio in rPPG case.

SpO₂ Estimation using facial image learning with CNN



Emphasizing the features around the nose and cheeks (areas where blood vessels gather on the body surface) by using Attention mechanism.
We attempted to learn and classify cases based on their severity (99-96, 95-94, 93-90%).

	SpO ₂ :90-93%	SpO ₂ :94,95%	SpO ₂ :96-99%
Total Data (7 subjects)	400 images	400 images	400 images
Leaning Data	320 images	320 images	320 images
Checking Data	80 images	80 images	80 images
relearning Data (another 1 subject)	100 images	100 images	100 images
rechecking Data	34 images	34 images	34 images



We found that this system distinguish the severity level by using small data set.