

Stabilization Library(STBLib) Instructions

- About Stabilization Library(STBLib)
 - This is for stabilizing the result of the number of object people, age, gender estimation and recognition, based on each frame output from HVC of human body/face detection and estimation results.
 - This can be used for counting people by tracking simply on each frame of face detecting result.
 - This also gives result with better confidence of age estimation by averaging the varied result in each frame.
- This document describes STBLib functional overview and Materials supplied from OMRON.

1. Materials supplied for STBLib

- List of Materials supplied for this Library
 - STBLib set
 - Binary file
 - Source code
 - Documents
 - STBLib Instructions (this document)
 - API specification document

* This library does not guarantee proper operation.

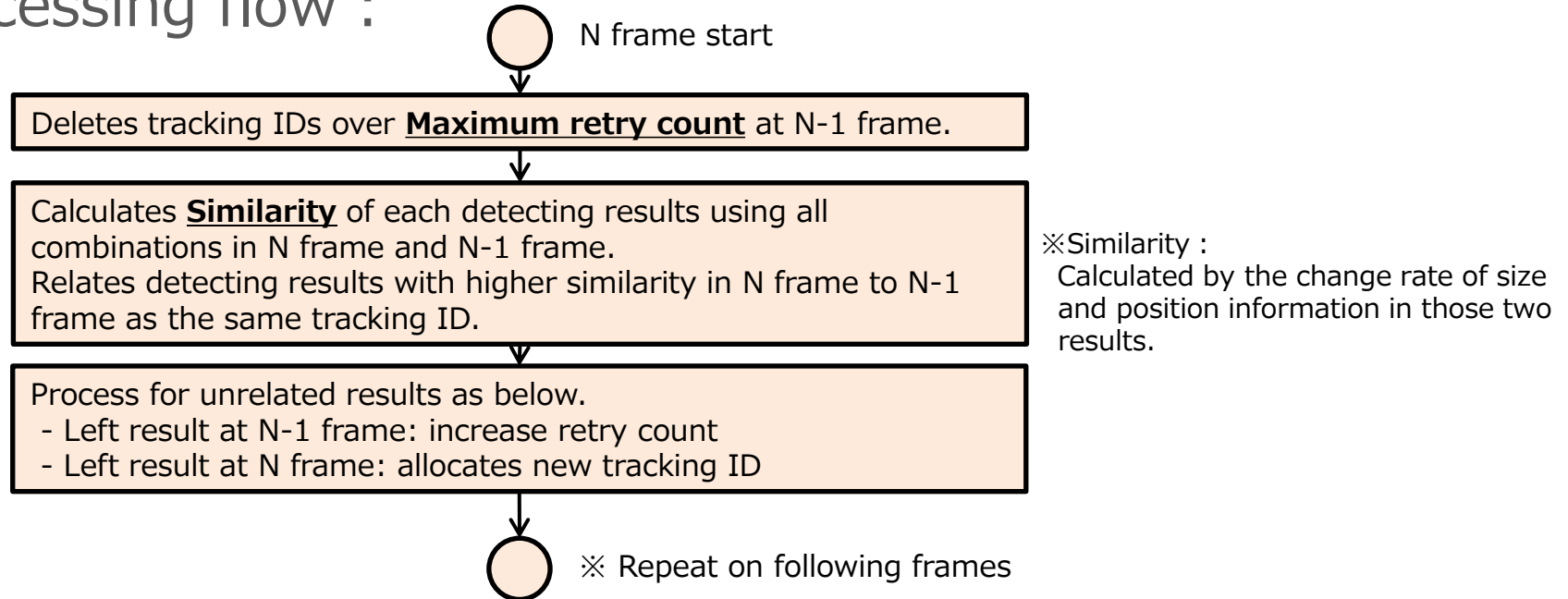
* This sample code is specialized for HVC-P2 and HVC-C2W.
Note that it will be assumed as agreeing **Terms of Use**
and Disclaimer of that products to use this sample code.

- Basic configuration
 1. Tracking
 - coverage(2 functions) : face detection, human body detection
 - Calculates whether the people of detected in previous and current frames are the same or not and allocates the same ID for the same person in both frames.
 2. Rectangle steadiness
 - coverage(2 functions) : face detection, human body detection
 - Steadies Face/Human body detection size and position information in each frame.
 3. Result stabilizing
 - coverage(7 functions) : Age/gender/expression/gaze/blink/face direction estimations and recognition
 - Object's movement or changing face direction and shooting condition may cause varying result of estimation in multiple frames for the same person. This function averages of those results by extracting results with higher confidence.

- Calculates detecting result of previous and current frames whether it is the same person or not and allocates the same ID for the same ones. This applies for both face and human body detection.

2-1. Tracking

- Processing flow :



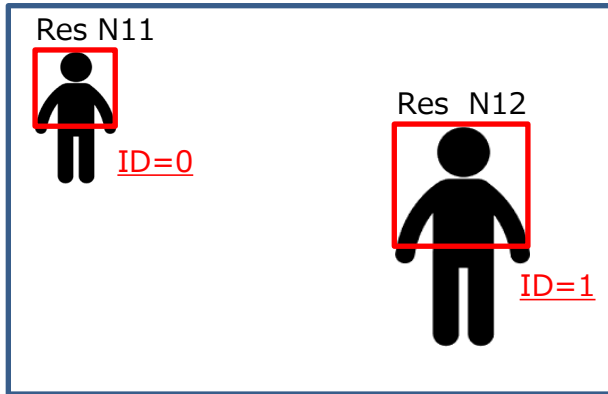
- Setting parameter

- Maximum retry count: (API name: `STB_SetTrRetryCount`)
 - To set the number of ahead frames to search in case of not getting connection of the detected result in a frame (loosing the tracking object).

2-1. Tracking

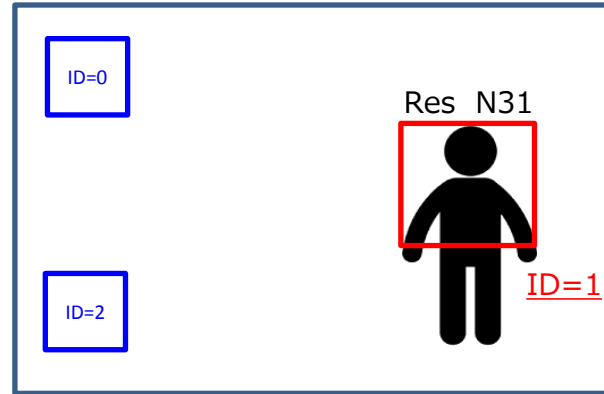
- An example of tracking set maximum retry count as "2" below.

N-1 frame * starting frame



- Give new ID for each result.

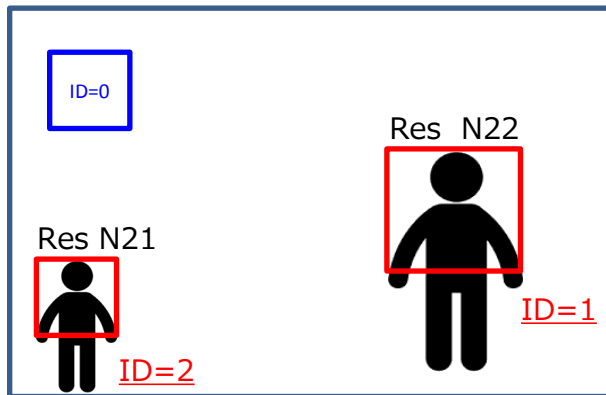
N+1 frame



Red : result related to ID
Blue : result in process of retry

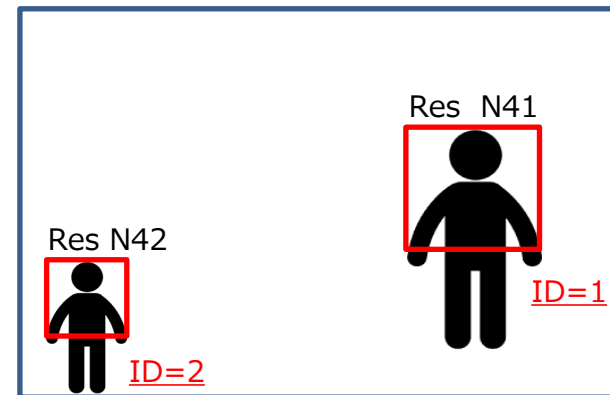
- ID=0,2 are in process of retry(blue)
- Relate Res N31 to ID=1

N frame



- ID=0 is in process of retry(blue)
- Give a new ID to Res N21
- Relate Res N22 to ID=1

N+2 frame



- Delete ID=0 as to be over the maximum retry count
- Relate Res N41 to ID=1
- Relate Res N42 to ID=2

.....

【Supplementary note】

- Similarity calculation ($\text{dstTbl}[A,B]$)
 - $\text{dstTbl}[A,B]$:
 - Indicates the similarity of “detected results of A in the previous frame and B in the current frame”
 - $\text{dstTbl}[A,B] = (\text{difP} + 1) * (\text{difS} + 1)$
 - difP = “Detected position shift rate (%)” = “Central coordinate distance of A and B / size of B * 100”
 - difS = “Detected size change rate (%)” = “Absolute value of A and B size change amount / Detected size of B * 100”

⇒ The smaller this value, the higher relation rate.
- Maximum Tracking ID
 - The available maximum tracking ID is “2,147,483,647” .

- Steadies rectangles by calculating position and size change rate in tracking rectangles.
 - This function steadies rectangles when there is a related ID in the process of “2-1. Tracking”.
 - Change rate means size change or position shift amount in previous and current frames. This is calculated based on the detected results of previous and current frames.
- Setting parameter: (API name: `STB_SetTrSteadinessParam`)
 - Rectangle position steadiness parameter(%):
 - Calculates related rectangle position change rate in previous and current frames. Uses the position of current frame when the rate is bigger than this parameter and follows previous position when it is smaller.
 - Rectangle size steadiness parameter(%):
 - Calculates related rectangle size change rate in previous and current frames. Uses the size of current frame when the rate is bigger than this parameter and follows previous size when it is smaller.

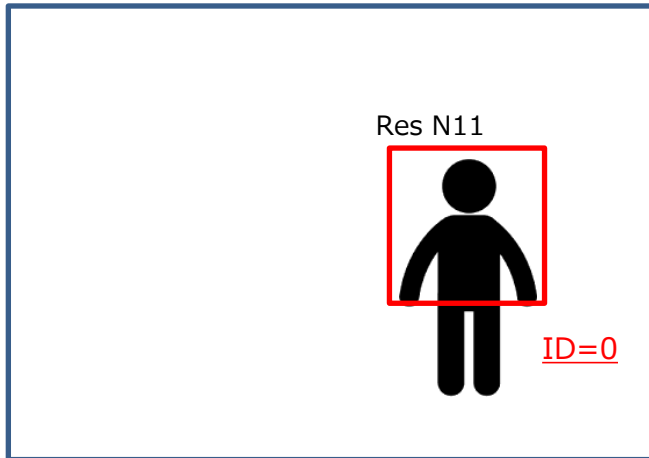
2-2. Rectangle Steadiness

- An example of the rectangle steadiness
 - Red rectangle shows the steadied result.

Blue rectangle : result before steadying
Red rectangle : rectangle steadiness result

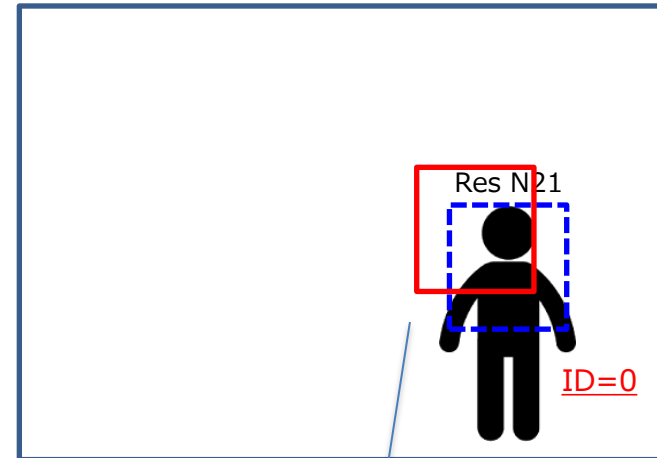
N-1 frame * previous frame

...



N frame * current frame

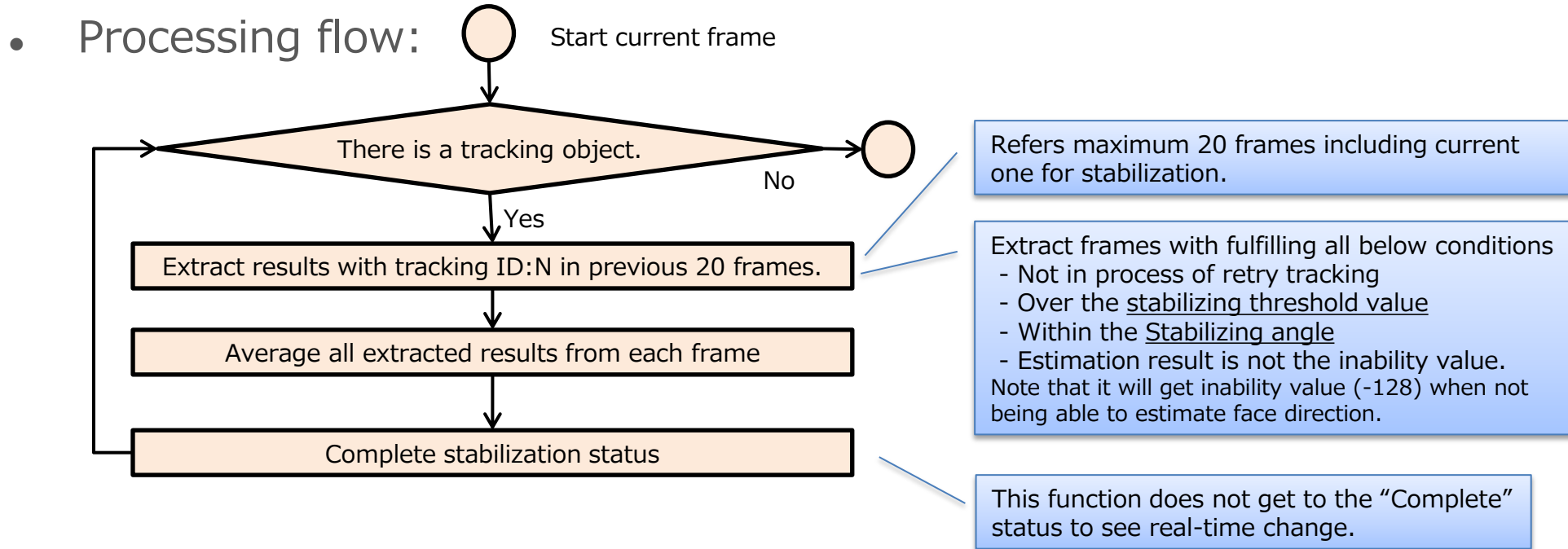
.....



- Rectangle position:
Uses the central coordinate of the previous frame as the smaller change rate of the set rectangle position steadiness parameter.
- Rectangle size:
Uses the size of current frame as the change rate of the size is bigger than the set rectangle size steadiness parameter.

- Object's movement or changing face direction and shooting condition may cause varying result of estimation in multiple frames for the same person. This function averages of those results by extracting results with higher confidence.
- This result stabilizing function applies to those 7 functions of age/gender/expression/gaze/blink/face direction estimation and recognition. Processing detail would be classified as below according to applied function.
 - expression/gaze/blink/face direction estimation
 - age/gender estimation
 - recognition

2-3-1. Stabilizing Expression/Gaze/Blink/ Face Direction Estimation

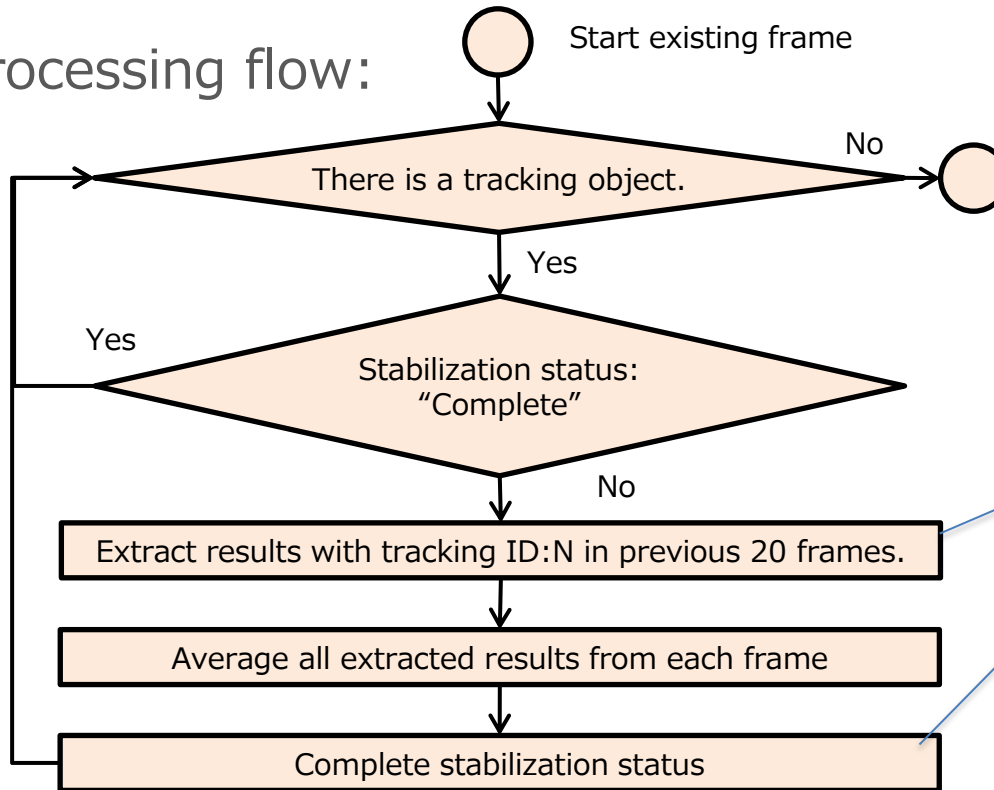


Setting parameter

- Stabilizing threshold value: (API name: `STB_SetPeThresholdUse`)
 - Threshold value for confidence by face direction estimation result. Without fulfilling this value, the estimated result does not be applied for stabilization process.
- Stabilizing angle: (API name: `STB_SetPeAngleUse`)
 - Threshold value for up-down/left-right angle based on the face direction estimation result. Without fulfilling this value, the estimated result does not be applied for stabilization process.

2-3-2. Stabilizing Age/Gender Estimation

- Processing flow:



Same as described previously.




Settled by Complete frame count(X)

It will be "Complete" when there are more extracted frames with tracking ID:N than (X).

- Setting parameter
 - Stabilizing threshold value, stabilizing angle: * refer [2-3-1] description
 - Complete frame count: (API name : STB_SetPeCompleteFrameCount)
 - The number of frames to complete the stabilizing result is configurable.

2-3-2. Stabilizing Age/Gender Estimation

- (Reference) An example of completing stabilizing status :
 - Described in a case of set complete frame count as 5

	L frame										M frame										N frame																			
																																								
Frame No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Result existence	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	○	x	x	○	x	x	x	○	x	x	x	○	x	x	x	○

Case at L frame -> "No data" status with no data of stabilizing object

Frame No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Result existence	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Case at M frame -> "Calculating" status without enough data of stabilizing object

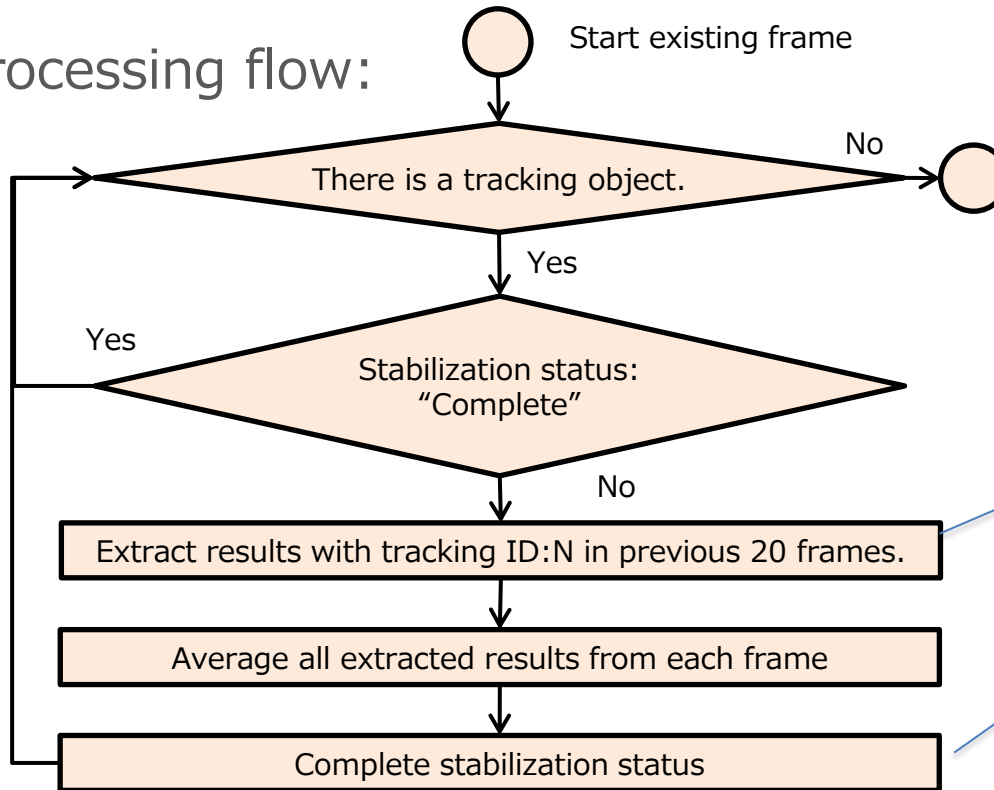
Frame No.	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Result existence	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Case at N frame -> "Complete" status with enough data of stabilizing

Frame No.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Result existence	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

2-3-3. Stabilizing recognition result

- Processing flow:



Same as described previously.

Settled by Complete frame count(X), Minimum account ratio(Y)

It will be "Complete" when a result gets more than the account ratio in complete frame count.




- Setting parameter

* refer [2-3-1] description

- Stabilizing threshold value, stabilizing angle, and complete frame count: (API name: `STB_SetFrThreshold/AngleUse`, `STB_SetFrCompleteFrameCount`)
- Minimum account ratio(%): (API name: `STB_SetFrMinRatio`)
 - Determine the User ID getting more than this set ratio in complete frame count.

2-3-3. Stabilizing recognition result

- (Reference) An example of completing stabilizing status :
 - Described in a case of set complete frame count as 5, minimum account ratio as 60.

											L frame										M frame										N frame									
																																								
Frame No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Recognition result	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	B	x	x	A	x	x	x	A	x	x	x	C	x	x	x	A

Case at L frame → "No data" status with no data of stabilizing object

Frame No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Recognition result	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Case at M frame → "Calculating" status without enough data of stabilizing object

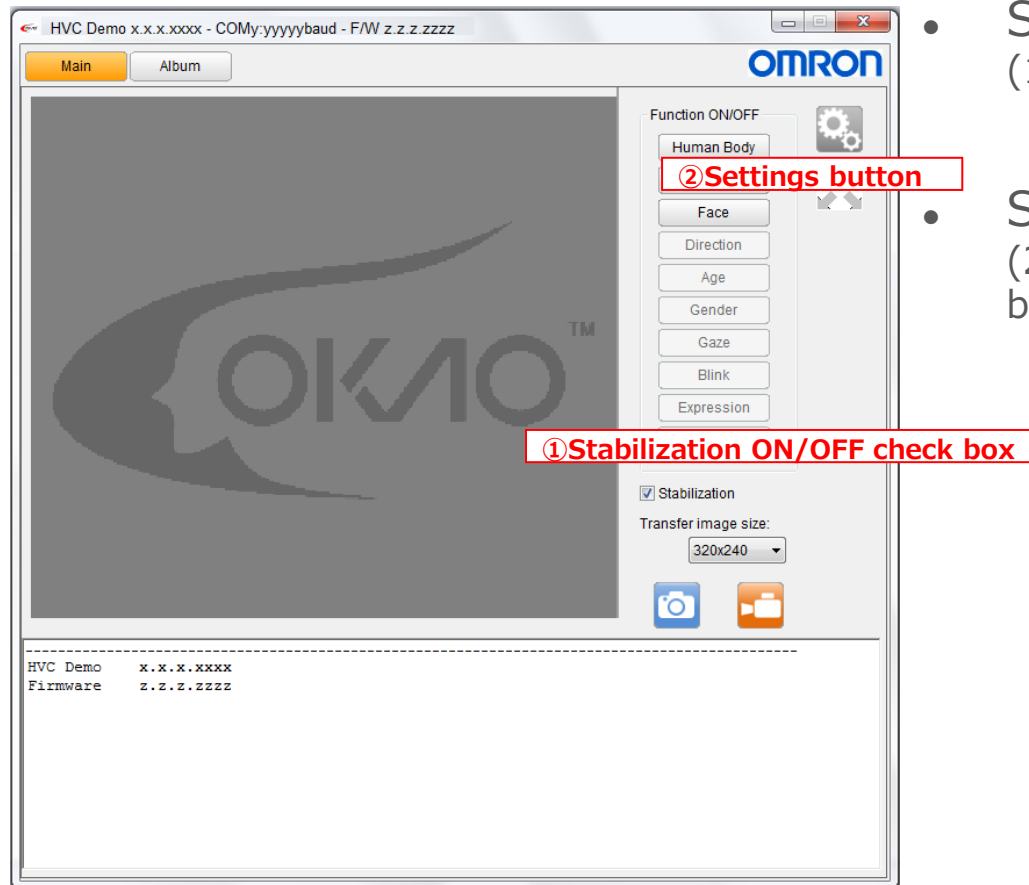
Frame No.	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Recognition result	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	B	x	x	A

Case at N frame → "Complete" status with enough data of stabilizing

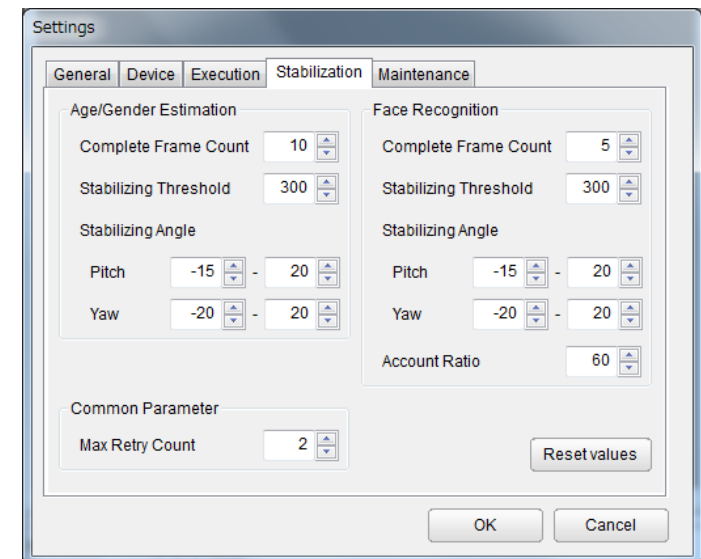
Frame No.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Recognition result	x	x	x	x	B	x	x	A	x	x	x	A	x	x	x	C	x	x	x	A

※The result would be ID:A with getting more than the account ratio as ID:A(60%), ID:B(20%) and ID:C(20%) for this case.

- This page shows how to set stabilization at the evaluation software provided for B5T-007001 series.



- Stabilization ON/OFF:
(1) Check stabilization ON/OFF check box.
- Setting parameter for stabilization:
(2) Display setting screen by clicking setting button and select the stabilization tab.



Revision History

Date	Rev	Contents	Prepared by	Reviewed by	Approved by
2016/12/01	A	First release	Urabe	Manabe	Yamada