Strategic Analysis Tool for Badminton

USER GUIDE

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Table of Contents

1.0 Introduction

The BStAT software application is a software tool use by a performance analyst to assist a coach or a player in badminton to analyse a game of badminton, in order to understand patterns of play or tendencies and habits of players in the game.

BStAT can be used to notate (code) events in a game of singles badminton. BStAT then generates simple counts, averages and percentage data with regards to any one, or combination of these events. With BStAT the user is able to segment and display video footage according to the corresponding events or statistical data currently being examined by the user. These videos can then be extracted to a computer hard drive. BStAT allows the user to generate a simple customizable report in order to include data specific to a particular game.

1.1 Requirements

LabVIEW Runtime Engine
LabVIEW Vision Runtime Engine
Windows XP or higher
K-Lite Codec Pack 5.4.4 (Full version)

1.2 Recommended

Windows Vista or Higher
17 inch monitor with resolution set at “1366 by 768”

2.0 Graphical User Interface (GUI) Layout

The BStAT software application consists of two major sections accessed as tabbed displays or user screens. The “Coding” tab accesses the section used for the manual notation process. The “Display” tab accesses the section used for generating statistical data, extracting data to a report, segmenting of video, and extracting videos to a hard drive.

The following section explains the concept of the software application, layout of the GUI, location and the name of the controls, indicators, displays, etc. The basic functionality of these is introduced, while detailed instructions on using the functions is provided in a later section.

2.1 Coding

The basic concept behind this section is for the user to watch a video playback of a badminton game, and at a specific point in the video at which an event of interest takes place to notate the event. To notate the event the user would pause the video playback at the time of the event, and key-in the relevant buttons to describe the event. The software application would notate the event and link it to the frame in the video at which the playback was paused.

The Coding screen contains a video display, main controls (used to code the events), initialization controls (used to select the length of video to be coded), and the playback controls (used to control the playback and manipulate the coding of the video).

2.1.1 Video display

Display the video footage for coding.

Figure 1.1: left half of the coding screen (Video display)

2.1.2 Main controls

2. File control: - indicate the video file to be coded and the location to save the coded data.
3. Position keys: - used to code the position of the players.
4. Player control: - used to indicate the side of the court on which the player is on.
5. Shot keys: - used to code the type of shot played.
6. Service keys: - used to code the service (start of rally).
7. Point keys: - used to code the winners/errors of players (end of rally).
8. START/STOP and SAVE buttons: - press to start the coding process and to stop and save the coded data

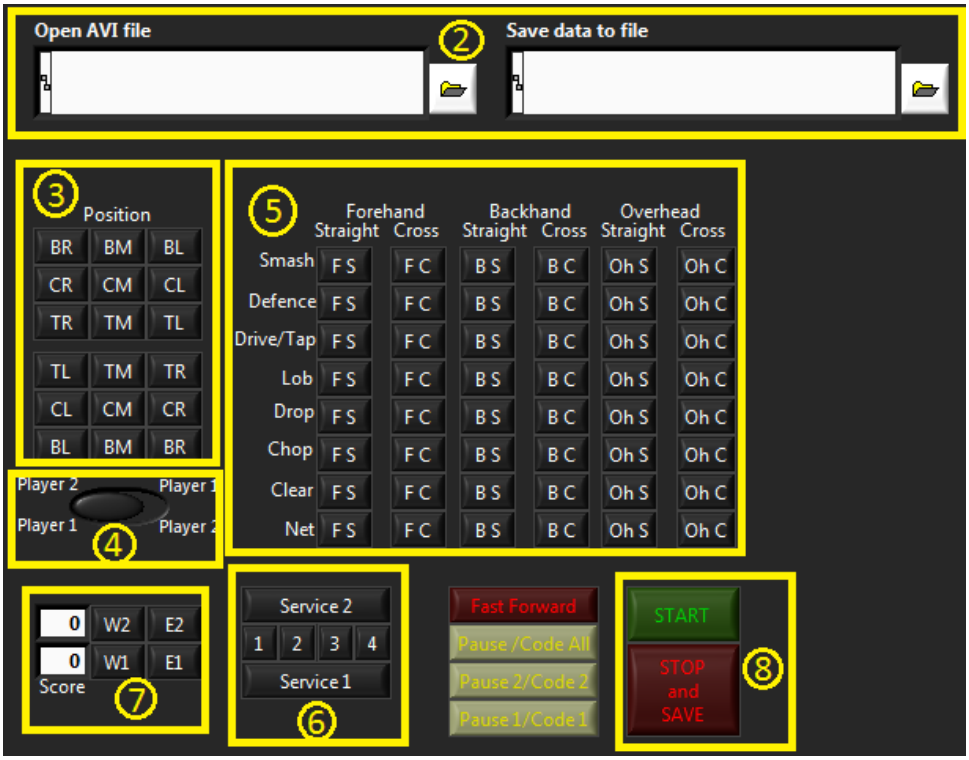

Figure 1.2: right half of the coding tab

2.1.3 Initialization controls

Located just outside the bottom right corner of the video display, these controls appear once the START button is pressed.

Figure 1.3: initialization controls

2.1.4 Playback controls

Located on the right half of the coding screen, below the shot keys, some of these are always visible while some appear after the initialization process.

9. Pause/Fast-forward keys: - used to control the playback
10. Playback speed control: - used to increase and decrease video playback speed.
11. Undo Code: - used to undo last coded event.

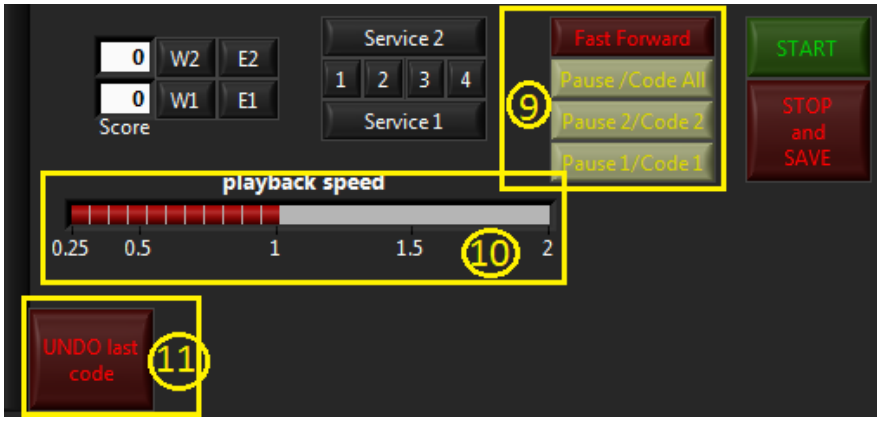

Figure 1.4: playback controls

2.2 Display

The basic concept behind this section is for the user to analyse a badminton game using the data obtained through the notational process. To analyse the game, a user would select different events of the game by choosing a combinations of buttons, and examine the segmented video footage, and numerical data related to the particular event.

The Display screen contains sections: video display and file control similar to the Coding screen, and a 2nd section providing controls used for the analysis and/or display purposes. The 2nd section is divided into three: “Edit”; for editing the coded data and video footage as required, “Data Display”; for display of the numerical statistical data, and “Momentum”; for the display of overall momentum related to points won during the game.

However the “Display” screen has a few controls arranged outside the areas explained above. The “Edit” screen contains one file control, while two Buttons are located outside the “Edit” screen near the “File Control” section. These are for functionality reasons and would be explained later.

2.2.1 Video display and file control

Similar to “Coding” screen. Refer to Figure 1.1 and 1.2.

1. Edit Video: - used to edit video footage of selected events
2. Generate Report: - used to initialize a report

Figure 2.1: file control

2.2.2 Edit

1. File Control: - file control used to indicate the location to save the edited video footage in to an .avi file.
2. Write to avi button: - used to initiate writing of edited video footage to an .avi file.
3. Shot select: - used to select shots to be edited.
4. Position select: - used to select the position on court (of the player) to edit.
5. Player select: - used to select the player to edit.
6. Score select: - used to indicate a score during the game at which to start editing the video footage.
7. Special event select: - used to select events that occur once per rally to edit from the video footage.
8. Playback control: - used to control playback of the video footage.

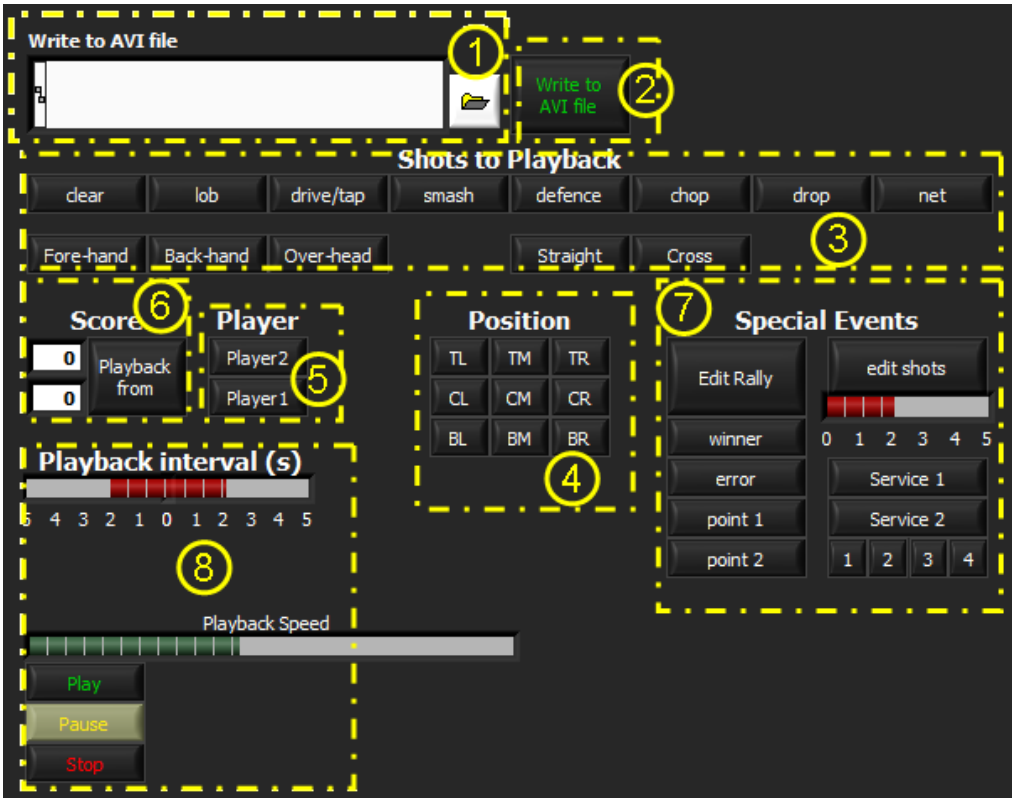

Figure 2.2: Edit screen

2.2.3 Data Display

1. Position display: - display data related to positions on the court.
2. Shot display: - display data related to types of shots.
3. Data Save slots: - used to temporarily save data currently being displayed.
4. Percentage key: - used to toggle between numerical counts and percentage data.
5. Section selector: - used to toggle between different sets of data.
6. Comparison tool: - used to compare two sets of data.

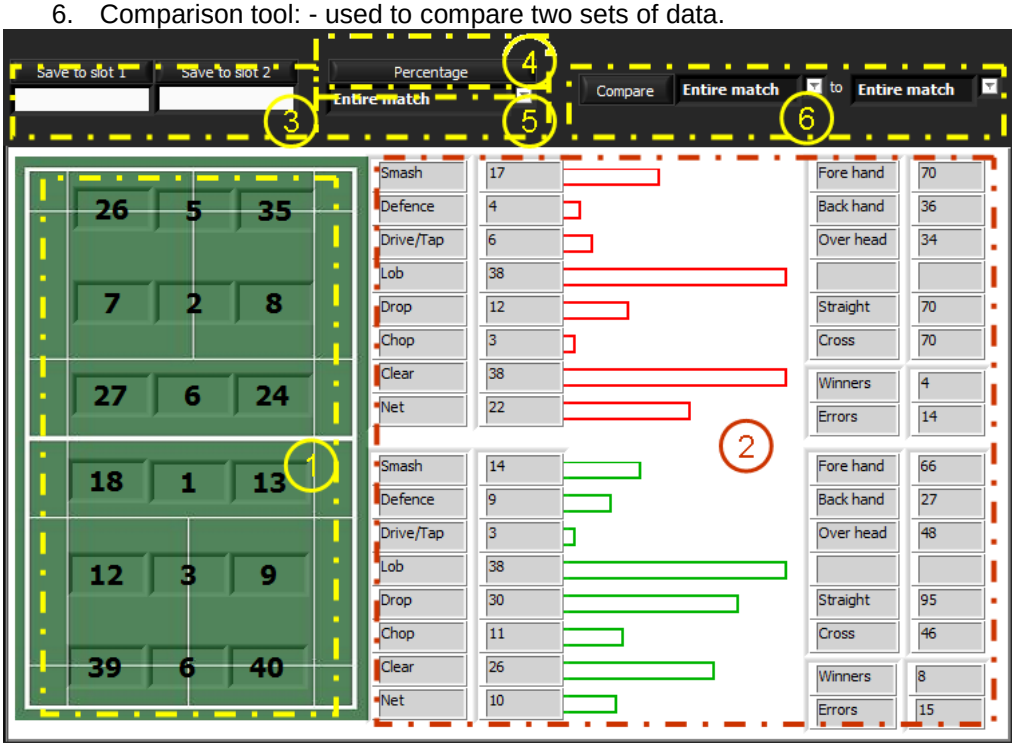

Figure 2.3: Data Display screen

2.2.4 Momentum

This screen contains a chart indicating the momentum data and several numerical displays.

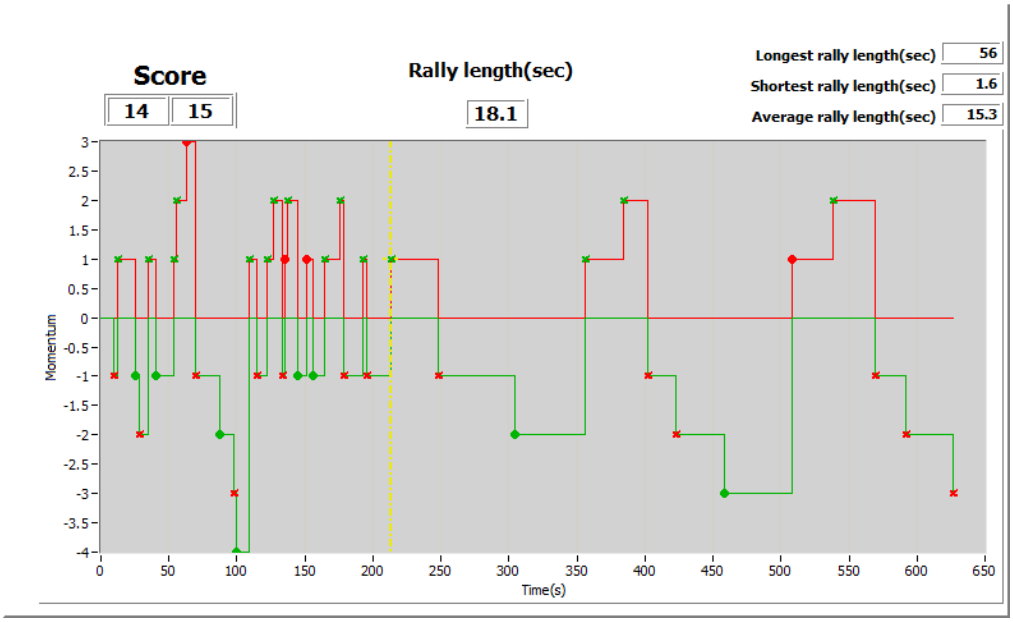

Figure 2.4: Momentum screen

3.0 Using BStAT

BStAT is used to notate events of a game of badminton (code), edit videos according to those events, and to display the resulting data.

Note that to use BStAT, the user requires basic knowledge of badminton and the shots played during a game. The author of the guide assumes that the reader is such an individual.

3.1 Coding a game of badminton

This guide will go through coding step by step, while explaining the uses of the controls/keys and their functions.

3.1.1 Step 1: File control

Select the "Coding" tab.
Click on the "open avi" file controls and select a video file (avi format) of a badminton game from hard drive to code.

Click on the "Save data to file" file control and select a file to save data to (xls format).
Note: - If a new file name is given, the data would be saved to a new file upon completion of coding. If an existing file is chosen the data is appended to the data existing on that file

Click on the "START" button to start the process.

3.1.2 Step 2: Initialization process

A few controls would appear just outside the bottom right corner of the video display. These are used to select the starting and end point of the video footage at which to start and finish coding.

Use the progress bar at the bottom of the video display to drag the video footage to the start point and click on "set start" button.
Drag the video footage to the end point and click on "set finish" button.
This would result in the frame numbers of the start and end point being displayed on the corresponding displays.

Click on the "DONE" button. The video footage would start playing from the start point.

3.1.3 Step 3: Coding

While the video is playing, BStAT works as a simple media player (media player mode) and cannot be used for coding. Coding can be done when video playback is paused (coding mode). BStAT uses the frame number of the video file (frame at which the video footage was paused), and associates that frame number with the events that are being coded.
Playback continues for 1 second (25 frames) in coding mode, immediately following the pause button being clicked. This is to allow the user to select the exact point at which the shuttle is hit by the player as the associated frame, while still allowing the user to see the shot being played. When returning to media player mode, playback resumes from the point at which it was paused.

To code, click "pause", select the applicable controls to notate the event (code), and click "pause" again. These frames are saved in the order they were coded and not in the ascending order of frames. This is because normally a video is coded as it is played.

To end the coding process and save the data, click "STOP and SAVE" button. A dialog box appears requesting permission to save the data in a spreadsheet file.

- **Player control:**

Badminton video is normally taken from behind one of the players on court. This situates a player on the near half of the court to the camera (near court) and his/her opponent on the further half of the court to the camera (far court). Appoint these players as "player 1" and "player 2".
Use the player control to indicate which player is on which half of the court. If player 1 is on the near court, slide the control to the left. If player 1 is on the far court, slide the control to the right.

Note the label for player 1 and 2 on the player control, where player 1 on the near court and player 2 on the far court corresponds to player one at the bottom and player 2 at the top and vice versa. The layout of most of the keys used for coding (except for the shot keys), are designed to reflect this.

- **Start of rally:**

Pause the video as the player serves and click on “service 1” or “service 2” corresponding to a service by player 1 or player 2 respectively.
Un-pause

For further detail coding, there are 4 optional keys that can be used in combination with the service keys to indicate different types of services.

Ex: - a service to the baseline could be called a “service 4” and to code player 1 serving to the baseline the user should click “service 1” and “4” keys.

- **During rally:**

The layout of the position keys is to reflect the position on the court. This is shown on a top view of a badminton court on figure 3.1. Table 3.1 explains the abbreviations used on the keys. Left, right, and middle is with respect to the player while he/she is standing facing the net.

TL	top-left
TM	top-middle
TR	top-right
CL	centre-left
CM	centre-middle
CR	centre-right
BL	bottom-left
BM	bottom-middle
BR	bottom-right

Table 3.1: abbreviations used in position keys

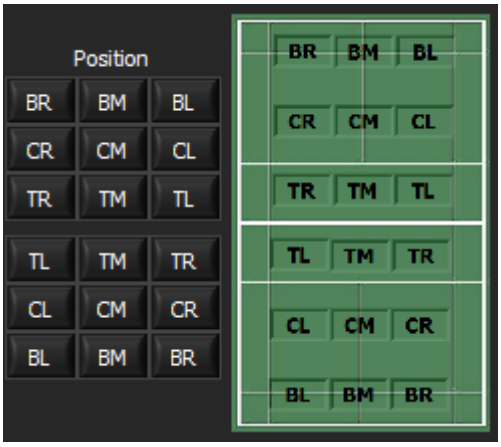

Figure 3.1: layout of the position key and the areas they refer to on a badminton court

A Shot in badminton is a combination of three different criteria. The shot itself (Figure 3.2), handedness of the shot (forehand, backhand, overhead) and direction (straight, cross).

The layout of the shot keys are in 8 rows, with 3 pairs of columns each. Each row represents one type of shot. Each pair of columns corresponds to the handedness of the shot with the two individual columns of each pair representing the direction.

Ex: - First pair is for forehand shots where the left column is for straight shots and the right column is for cross shots.

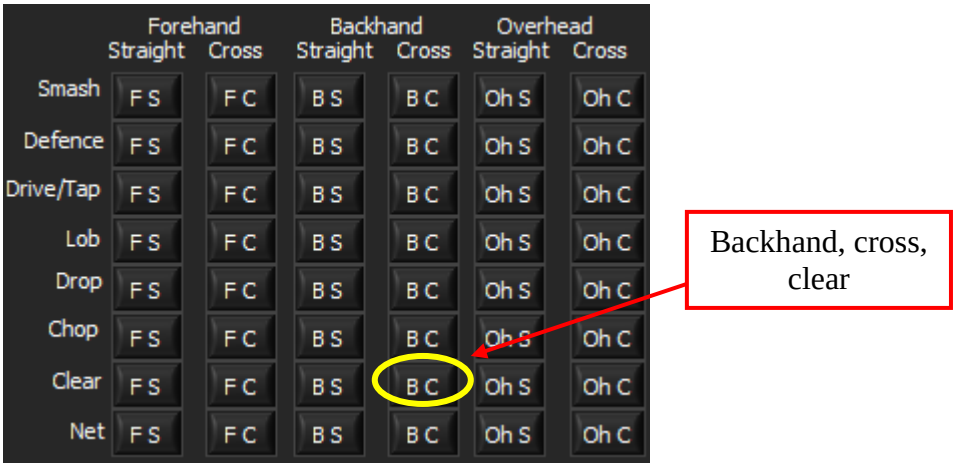

Figure 3.2: layout of the shot keys and their labels

To code during the rally, pause as a player is playing a shot. Click on the position key corresponding to the player's position. Click on the shot key corresponding to the shot being played.
Un-pause

- **End of rally:**

End of a rally is the shot resulting in a point being won by either player due to a winning shot (winner) or an error made by the opponent (error). This can be coded using the point keys, and is the only event that can be coded while in media player mode (video playing) during the break in play following the point. This winner/error is associated with the last shot (event) coded and saved as such.

W1	winner by player 1
W2	winner by player 2
E1	error by player 1
E2	error by player 2

Table 3.2: abbreviations used in point keys

Note: - the end of the rally coding can be done in media player mode (without pausing)

- **Undo coding:**

If a mistake is made in coding the user is expected to correct this immediately, it can be undone by pausing and clicking on the "undo last code" button. This will remove the last coded value. Clicking twice would remove the last 2 coded values.

- **Pause 1 / Pause 2:**

By using the service 1 and service 2 keys, the user codes the service with reference to the player performing the action. The same is true at the end of a rally where the player performing the winner or the error is indicated with the key being pressed. During the rally the player performing the action is known through the position keys.
However it is possible for BStAT to be used to code just the shot being played, without regards to the position of the player. In this situation, if the user wishes to associate the shot being played with the player performing the action the video playback is paused using "Pause 1" or "Pause 2" keys. Pause 1 to indicate player 1 and Pause 2 to indicate player 2.

This process is continued to the end point on the video playback, following which the coded data can be saved to a spreadsheet file.

3.2 Editing/playing/writing video according to events

This guide will explain the procedure to follow in editing a video, while explaining the uses of the controls/keys and their functions.

3.2.1 Step 1: File control

Select the “display tab”
Click on the “open AVI” file controls and select a video file (avi format) of a badminton game from hard drive to.
Click on the “Read data from” file control and select the coded data file related to the video footage.

3.2.2 Step 2: Select events

Select events by clicking on the relevant buttons.
Selecting an indicator would search the video for instances where that indicator was coded. A combination of indicators would select instances in the video footage with ALL of the selected indictors coded. The indicators are the same as the ones used in the coding. A combination can have as many 6 individual indicators (shot, handedness, direction, position on court, player, and point). If the particular combination of events were not present in the game, it is indicated on a popup message.

Ex: - If “net” is selected, all instances in the video where a net shot is played are extracted. If “player 1”, “net”, and “winner” are all selected, instances with a winning net shot by player 1 are extracted.

Selecting the “playback from” button and entering a score on the adjacent controls would prompt BStAT to search the video for events following that score-line. If the particular score was not present in the game, it is indicated on a popup message.

Video is edited with respect to time leading up to, and following an event. “Playback interval” control is used to edit this interval. “0” indicates the instance of the event. The bar can be dragged to either side of the event to select the number of seconds leading up to and following the event to extract. If two or more instances of an event occur close enough to each other that the time intervals overlap, the overlaps would be removed.

Use the “edit rally” button to extract entire rallies (from service to point) containing the selected events. This would override the “playback interval” setting.

Use the “Edit shots” button when extracting starts (service) or end (points) of rallies. This would automatically edit the selected number of shots following the start of the rally or leading up to its end.

To edit the video click on “Edit video” button located near the file control.

3.2.3 Step 3: Playback

Click “play” to play the edited video (media player mode). The speed of playback can be adjusted using the “playback speed” control.

Click the “stop” button to initialize “editing mode”, and follow the previous steps to edit.

3.2.4 Step 4: Writing videos

Click on the “Write to AVI” file controls and enter a file name with the extension *.avi to write video footage on to hard drive.
Click on “Write to AVI file” button to initialize. This writes the last edited video footage to the selected file.

3.3 Displaying notated data related to the game

This guide will explain the data available on the “data display tab” and “momentum tab”.

3.3.1 Step 1: Select “data display” tab

Use the “section selector” to choose a set of data (Entire match or edited section) to be displayed. Entire match displays the data related to the full length of video footage. Edited section displays data related to a section of edited video footage.

Note that the charts and graphs in green, and data located at the bottom half of the screen are data of “player 1” while those in red and at the top half of the screen are of “player 2”.

Position display: - indicates the counts of instances occurring at each position.
Shot display: - indicate the number of each shot, shots by handedness, and shots by direction.

3.3.2 Step 2: Display percentages

Click on “percentage key” to display the data as a percentage of all the similar events related to one player.

3.3.3 Step 3: Temporary save

Click on “data save slot” to temporarily save the data currently on display. This is used to save one set of “edited data” to be used later for examination or comparison with another set of “edited data”. The slots can be named according to the edited data set saved, for ease of memory. The “section selector” can be used to view the data saved in the slots.

3.3.4 Step 4: Compare values

The comparison tool displays values of one set of data as a percentage of another. To do this task, click on the “compare button” and then select the two sets of data to be compared. The data of the selector on the left would be displayed as a percentage of the data of the selector on the right.

Ex: - Edit the straight smashes and save the data to “slot 1”. Click on “compare button”. Select “slot 1” and “entire match” on the selectors on the left and right respectively. The data related to the straight smashes would be displayed as a percentage of all the shots through out the game. Use slot 2 with slot 1 to compare two sets of edited data.

3.3.5 Step 5: Select “momentum” tab

This is a chart of momentum (consecutive points won) with respect to the time, with several self explanatory display indicators such as longest, shortest and average rally lengths.

The “player 1” (green) is at the bottom (negative half of the Y-scale) while “player 2” (red) is at the top (positive half of the Y-scale). Crosses on the chart indicate points won on mistakes made by the opposing player, while dots indicate points won by clear winners.

The X-scale indicates the time in seconds, and the length of the line preceding a point indicate the length of the rally resulting in the point.

A yellow colour cursor which can be dragged across the X-scale values can be used to view the score (Score indicator) at a point in the match and the last rally length (rally length indicator).

3.4 Creating a report

Click on “generate report” button to initialize a predefined report format to be used with the BStAT software. This report can be edited and saved, much like a normal MSWord document file.

To export data from the BStAT display interface to the text document, right click on the left border of the data display (white) area of the “data display tab” or “momentum tab” and select copy. This would copy the data to the clipboard and this can then be copied to the text file.

Edit information on the report accordingly and save to a desired location.

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