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DataandProcessSimulationofRecognitionRystemforDescentPointTrajectoryofBadminton

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Abstract

In recent years, with the increasing attention to badminton in competitive sports and the upcoming Tokyo Olympic Games in 2020, whether our badminton team can continue to break through and achieve good results has become a major focus. Each badminton team has a high requirement for its athletes' movement skills, so it is crucial to provide timely and effective feedback of the flight parameters of badminton to the coach after the players hit the ball during training and competition. In this study, the landing point and trajectory of badminton were captured and analyzed, and a data and process simulation system with technical and tactical guiding significance was designed to improve the training of badminton.

Keywords: *Badminton, Data and Process Simulation System ,Descent Point trajectory,Software; Statistics*

1.Introduction

Badmintonhasbeenenjoyingpopularityandextensivep articipationforalongtimeamongsportsevents.Asahighl ycompetitiveballgame,itischaracterizedbyhighintensi ty,highskillandfiercecompetition,andthekeytosuccess inthegameforathletesistheeffectiveuseoftechniquesan dtimelycoaching.Intheregularlarge-scalecompetition court,thecoachcanonlyprovideguidancewhenthescore is11pointsinthemiddle.Howtofindactionlawsofdiffere ntathletesthroughscientificdetectiontechnologydurin gthegameortraining,andthenimprovetheirskillsandtac ticalabilitiesthroughtargetedscientifictrainingisoneoft hekeytechnologiestoimproveskillsandtacticsofballsp orts.Atpresent,duringthecourseofabadmintongame,th etrackingandrecognitionofthebadmintoncanbeachiev edmainlybycapturingthevideoandimagethroughtheca mera,followedbymanualidentificationandanalysis.As wellasthedevelopmentofinformation,imagerecognitio nandcommunicationtechnologies,itispossibletoproce sssimulationandanalyzethetrajectory,speed,andtechni calandtacticallevelsofballsports.

2.Designobjectives

Afterthegame,thesinglesgamevideooftheBadmintons hotonthespotisimported,andanalgorithmisautomatica llyusedtocalculatethetechnicalparameters,suchasland ingpoint,over-netpace,badmintonflighttrajectory,etc., andareasoftechnicalactionsandpositionsoftheattackan ddefense(strikepointandlandingpointarethepositionso fthebadminton)aremanuallyannotated.Statisticsofacti ons,route,pace,landingpointandotherrelatedtechnicali ndicatorsofattackanddefenseinthegamecanbeobtaine d,andthestatisticalresultscanbeusedtosimulationtheat hlete'stechnicalandtacticallevelsandcharacteristics.In thesinglesfinalbetweenLinDanandLiZongweiatthe20 12*LondonOlympics*,Linusedtheliftmoreinfrontofthen et,andthebadmintonhadalowarcandfastspeed,whichin

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terruptedtheopponent’srhythmandfootworkinfrontofthenet[1].Sometimes,theathleteusesthemethodofdeceptiontoconfusetheopponentandgetapoint.Therefore,theinterventionofmultimediatechnologywillenablethecoachtoconductmorecomprehensiveon-siteguidance.Byrecordingthesedata,theperformanceoftheopponentcanbeobservedinthevideotoanalyzethedataandsummarizetheproblemsintheusualtrainingandcorrectthemintime[2].

Note:Allinterfaceimagesinthepresentstudyaredesignsketches,whichhavesomedifferenceswithactualeffectsofthesoftware.

3.SystemIntroduction

Table1.Trajectoryrecognitionsystemofdescentpointofbadminton

	Components	Performance or functions of parameters
Hardware part	Frame rate	2048×2048@400fps
Software part	Image part	Conversion, import, storage, extraction and compression
	Landing point of badminton	Tracking and delineation of over-net image and position, trajectory
	Pace of badminton	Calculation and statistical analysis
	Court marking	Probability statistics for position and area of landing point
	Privilege management	

4.Algorithmsintroduction

4.1Flyingtrajectoryofbadminton

Theopticalcameraparametersarepreciselyselectedtoensurehigh-speedandclearimagecaptureofthebadmintoninthеair.Additionally,basedoncomputervisiontechnologyinthefieldofartificialintelligenceandaccordingtothegamesceneandimagefeatures,sub-modulesofalgorithmaredesignedandimplemented,includingbadmintondetectionandidentification,trajectorytrackingsimulation,etc.Finally,thefinalsynthesisisconductedtoobtainflightsimulationinformationofthebadminton.

4.2Over-netpace

Basedonthebadminton’sflighttrajectoryacquiredbythehigh-speedcamera,thebadminton'snettrajectoryisautomaticallyinterceptedanditsdisplacementiscalculated.Finally,thecorrectedreferenceobjectsofthecourtareusedtoobtaintheactualover-netpace.

4.3Automaticidentificationoflandingpoint

Throughmanyanalysesofthelandingpointunderdifferentflighttrajectoriesofbadminton,thecharacteristicsoftrajectorydirection,paceattenuationandbounceareproposedtodesignanexpertsystemforthejudgmentandaccurateidentificationoflandingpointforthebadminton.

4.4Detectionalgorithmflowchart

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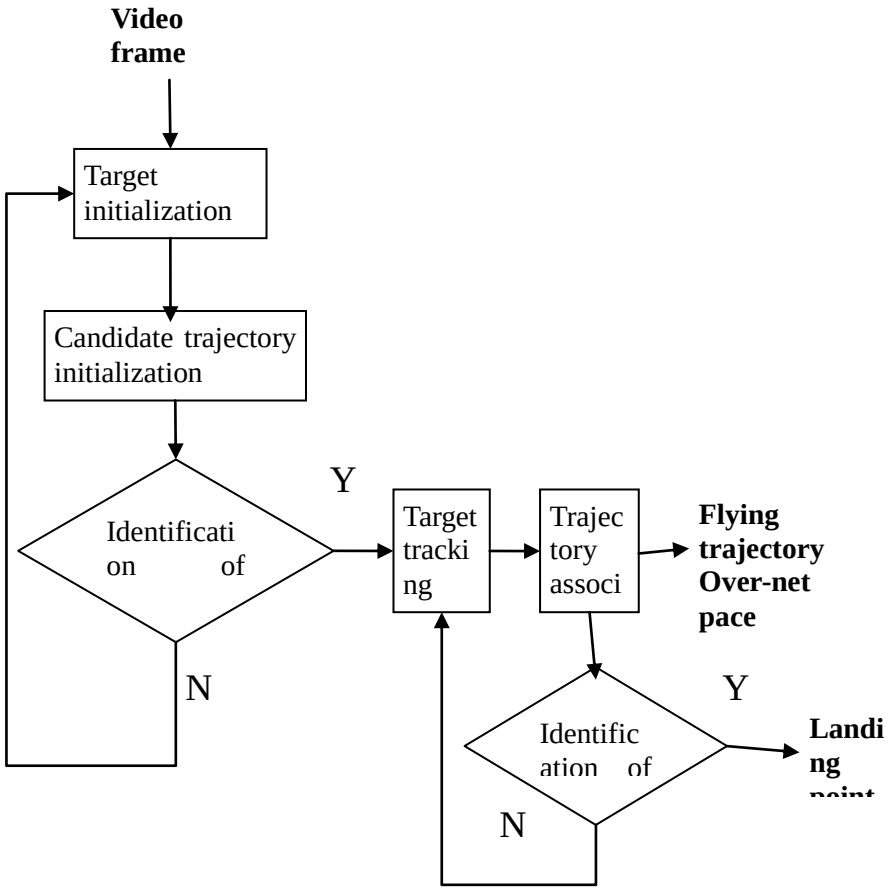

Figure1.Detectionalgorithmflowchart.

5.Softwareusageprocedure

Theofflineanalysismethodisusedinthesoftware,andthevideoisimportedforanalysisandprocessingafterthematch.Theanalysisandprocessingincludeanalgorithmtoautomaticallyidentifythelandingpoint,over-netpace,flighttrajectoryofbadminton,manuallyannotatedlandingpointarea,strikingpositionareaofathletes,techniquesandactionsofattackanddefenseforathletes.Forexample,thecommonforecourtcross-courtdroptechniqueinvolveshittingthebadmintonatforecourtinaslightlyhookedmannerovertotheothercorneroftheopponent'scourt[3].Itisusuallyusedbyathletesasatechniquetomobilizetheopponents.Thesuddenstrikewillforcetheopponenttochangetheoriginaltechnicalaction.Thestrikecanbeeitherahighpointoralowpoint[4].Atthismoment,wecanfocusonanalyzingtheparametersoftheforecourttoobtaintheccorrespondingdata.

Thereisalsoaclassictacticinthecourt–deception,whichhasnocleardefinition.Aslongastheflighttrajectoryofthebadmintonischangedorthestrikeleadstomisjudgmentbytheopponent,itcanbecalleddeception[5].Thedeceptionactivitycanbedividedintothreeaspects:changingdirectionandspeed,usingbodymovementandeye-gazingdirection.whichdependsonthebasicconsciousnessofathletes[6,7].Therefore,thisactioncanbedividedintotwoormorebasicstrokesforsubsequentanalysis,andthespecificoperationispresentedasfollows:

5.1Startupinterface

Agamevideoisselectedtoperformmanualannotation,gamereplay,datastatistics,andotheroperations.Newgamevideoscanbeimportedviathe“ImportVideo”button.Iftheimportedvideofileismanuallydeleted,thesystemwillautomaticallydeletethecorrespondingvideoinformationfromthelist.

5.2Courtlabeling

Theofflineanalysismethodisusedinthesoftware,andthevideoisimportedforanalysisandprocessingafterthematch.manuallyannotatedlandingpointarea,strikingposi

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tionareaofathletes,techniquesandactionsofattackanddefense.Accordingtothecharacteristicsofattackingroutefor thebadminton,thetwohalf-courtsaredividedintonineareas,asshownbelow.

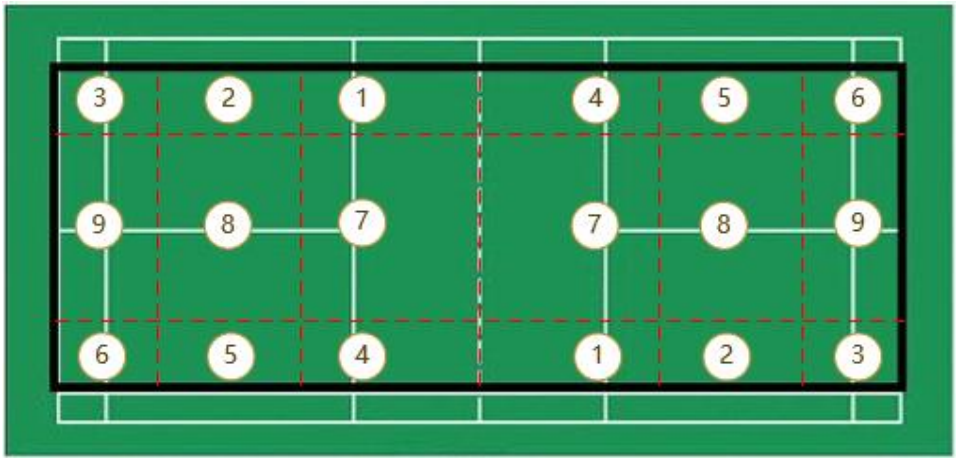

Figure2.Schematicdiagramofpartitionofthebadmintoncourt.

5.3FileImport

First,thevideofileiscopiedtothesoftware-specifieddirectory,thenthe“ImportVideo”buttonisclickedatthemaininterface,thevideofiletobeimportedisselected,therelevantinformationisentered,andthe“ConfirmImport”buttonisclicked.Videoinformationisautomaticallyaddedtothevideolist.

5.4Manualannotations

Atpresent,thealgorithmcansimulationthebadmintonfromthevideoscreenandanalyzeitslandingpoint,flighttrajectory,over-netpaceandotherinformation.Thebasicprocedureofmanualannotationsisasfollows.

Iftheconversionofattackanddefenseisfast,ortheoperatorisnotsufficientlyskilled,thevideoplaybackspeedcanbedecreased,thusensuringinputofrelevantinformationinatimelyandaccuratemanner.

5.5Functioninterface

Userscanplay,pause,andstopplayingthegamevideoatanytimeusingthe“playbackcontrol”button.The“playbackspeedcontrol”buttoncanreduceorincreasetheplaybackspeed.Theplaybackprogressbarcanbeadjustedatwill,andthevideoplaybackcanbeautomaticallysynchronized.

Basedonactionsoftheathletesinthevideo,whentheathletestrikeswiththeracket,usersclicktheareawherethestrikepositionislocated(Noneedtoclickontheprecisearea),thentheactionnameofattackanddefenseontherightsideisclickedorthecorrespondingshortcutkeyispressed,thesystemautomaticallygeneratesanactionrecord,whichisaddedtotherecordofactions.Ifanoperationalerroroccurs,userscanclickonthepreviousactionrecordintheleftactionrecord,andthevideowillautomaticallystartplayingfromtheattackanddefenseaction;re-annotationcancorrectthepreviousmistakes.

Belowthevideo,accordingtotheinformationsetwhenthevideowasimported,thenamesofathletesandhalf-courtsforbothsidesaredisplayed.Inthegame,afterthetwosideschangecourts,usersshouldclickthe“changecourts”buttonorthecorrespondingshortcutkeytochangethepositionofathletesonbothsides.Alltheactioninformationbythemanualannotationsautomaticallymatchesthecorrespondingathlete.

5.6Gamereplay

Thecomparisonbetweenmanualannotationsandresultsofalgorithmanalysiscanbecheckedintheleftlistforthereview.

Thereal-timelocation,action,route,landingpoint,flighttrajectory,over-netpaceandotherinformationofthebadmintoncanbeautomaticallysuperimposedonthevideo,andthecorrespondinginformationcanbeswitchedatthebottomlefttosynchronouslydisplayinthevideo.Intheretheplayprocess,themanualcountingmethodcanalsobeusedtocalculatethenumberofpointslost,especiallythosedueto activefault.Meanwhile,itisnecessarytoconductstati

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sticalanalysisoftheopponent'sfaultpointsandcreaterelatedrecordsforsubsequentanalysis[8,9].Previousstudieshavesuggestedthatbyreplayinggameactionsusingmultimediatechnology,morebadmintonplayerscanlearnskillsandpacesfromtheseexcellentathletes.Itcanstimulatetheirinterestinlearning.Hence,theycancorrecttheirmistakesintime,andalsomakethelearningprocessclear,therebycontributingtotheirconcentrations[10,11].

5.7Datasimulation

Thetechnicalandtacticalstatisticsforbothsidesofthebadmintongame,includinglandingpointanalysis,over-netpaceanalysis,andactionstatisticsundergoautomaticsimulationbytheexpertsystemaftertheprocessingofalgorithm,andtheabove-mentionedkeytechnicalandtacticaldataareextractedasfollows.

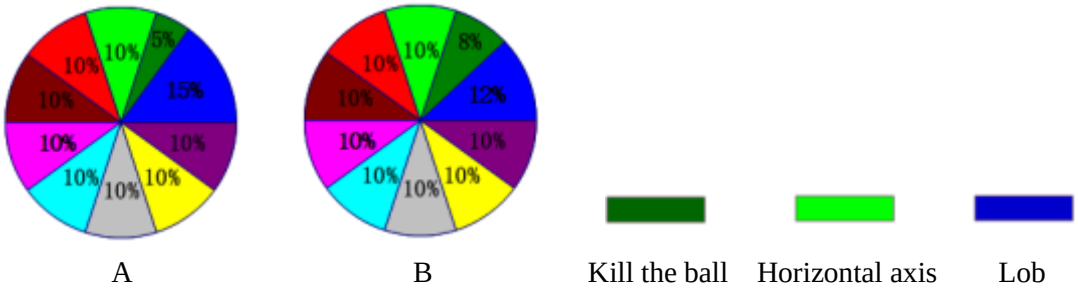

Figure3.Datastatisticsforthefrequencyandproportionofstrike.

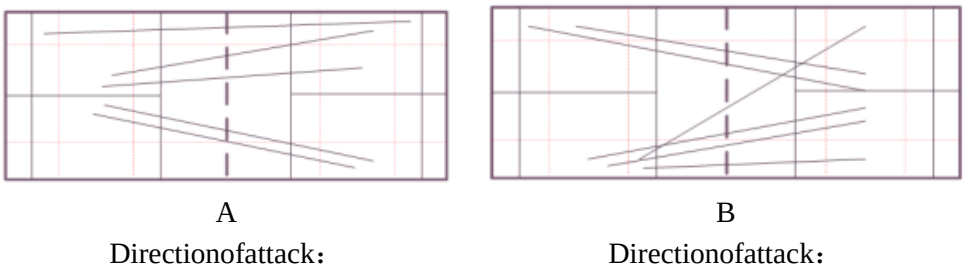

Figure4.Cartogramofattackingroute.

6.Summary

Basedonthetestresultsofrecentmajorinternationalbadmintoncompetitions,thissystemhasfunctionaladvantagesespeciallyinthebadmintonover-netpace,attackingrouteandstriketechnology.Thissystempartiallycompensatesfortheerrorsofthecoach'ssubjectivejudgmentsinthefield,anditcanalsoprovideeffectiveinformationforpreparationsduringpre-matchtrainingandpost-matchadjustment.Thepresentstudycontributestotheresearchanddevelopment,helpstotackleproblemsintheOlympics,andjointlyoffersadvicetotheChinesebadmintonteam.

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