Heart Disease Prediction using Artificial Intelligence

*Submitted in partial fulfilment of the requirements*

*of the degree of*

BACHELOR OF ENGINEERING

*in*

INFORMATION TECHNOLGY

(A.Y. 2018-2019)

by

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| Varun Mishra (Roll No.: 47)  Darpan Mehra (Roll No.: 42) |

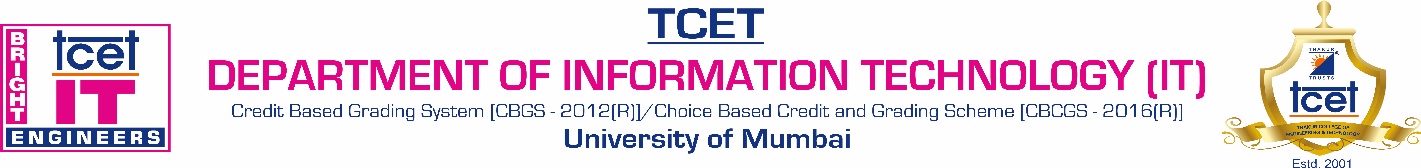
Under the Guidance of

Mr. Shridhar Kamble

Assistant Professor, I.T Department, TCET



**University of Mumbai**



**\**

**Project Report Approval for Bachelor of Engineering**

This project report entitled ***“Heart Disease Prediction using Artificial Intelligence”*** by ***“Varun Mishra (Roll No.: 47), Darpan Mehra (Roll No.: 42),*** is approved for the degree of ***BACHELOR OF ENGINEERING in INFORMATION TECHNOLGY***.

|  |  |
| --- | --- |
| Signature :------------------------------Name : Guide’s Name  Designation | Signature :------------------------------  Name : Dr. Rajesh S. Bansode  HOD-IT |
| Signature: ---------------------------------------------  Name : Dr. B. K. Mishra  Principal,  Thakur College of Engineering and Technology. | |

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| --- |
| **Examiners** |
| 1. Signature :---------------------------------   Name : |
| 1. Signature :---------------------------------   Name : |

Date:

Place:

**Certificate**

This is to certify that Mr./Ms.\_\_\_\_\_\_\_\_\_, Mr./Ms.\_\_\_\_\_\_\_, Mr./Ms.\_\_\_\_\_\_\_\_\_,

are bonafide students of Information Technology Department, Thakur College of Engineering and Technology, Mumbai. They have satisfactorily completed the requirements of PROJECT-II as prescribed by the University of Mumbai, while working on “Heart Disease Prediction using Artificial Intelligence”.

|  |  |
| --- | --- |
| Signature :------------------------------Name : Internal Guide’s Name  Designation | Signature :------------------------------  Name : Dr. Rajesh S. Bansode  HOD-IT |
| Signature: ---------------------------------------------  Name : Dr. B. K. Mishra  Principal,  Thakur College of Engineering and Technology. | |

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| --- |
| **Internal Examiner: External Examiner:** |
| Signature :--------------------------------- Signature :---------------------------------  Name : Name : |
| Thakur College of Engineering and Technology, Kandivali(East) Mumbai.  Date:  Place: |

**Declaration**

I/we declare that this written submission represents my/our ideas in my/our own words and where others ideas or words have been included, I/we have adequately cited and referenced the original sources. I/we also declare that I/we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my/our submission. I/we understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

----------------------------------------- (Signature)

1.---------------------------------------------

2.---------------------------------------------

3.---------------------------------------------

(Name of studentandRoll No.)

Date:

**ACKNOWLEDGEMENT**

We sincerely thank our principal, Dr. B. K. Mishra, Vice Principal, Dr. Deven Shah, Dean Dr. Kamal Shah, HOD, Dr. Rajesh Bansode for always encouraging us to do our best. We are highly in debt to our guide Mr. Shridhar Kamble who supported and constantly supervised us through this project and helped us not only in completing this project but also to provide us with ample amount of knowledge which was indeed beneficial to us.

1.---------------------------------------------

2.---------------------------------------------

(Name of student and Roll No.)

**Note:** While writing the acknowledgement all students are supposed to follow the hierarchy in the order of principal, Mentor Dean, HOD, guide, colleague, parents as applicable.

**ABSTRACT**

Though machine learning is not a new technology, there are new developments coming up faster than most people can learn them. It is a cutting-edge technology in every sense of the word. In such a case, it is necessary that we handle it with care. It could very well throw up results at an accuracy rate that is infeasible for medical applications. The capabilities required for the project are fairly in the feasible range. Most of the planned feature hinge around processing datasets. Due to the above, a challenge also visible here is the problem of dealing with huge amounts data and processing it thoroughly to get proper results.

The central parameter of success is the accuracy at which the machine learning algorithm predicts the diseases for which it is trained. It is expected to be above 96% - 98% to make a real difference, as medical diagnosis has very rigorous standards [2]. The secondary parameters are the response and loading time of each modules. A high value of module latency can make any user impatient. Besides these 2, the other parameter is the number of features that work without any bugs. This parameter should be ideally above 90% as well, or it can make users frustrated.

Although machine learning is a nascent specialization, we found an abundance of algorithms, not just in the proposed state, but rigorously scrutinized in research papers. Convolutional neural networks were suggested for their high accuracy. Chinese researchers had used Convolutional neural networks in a large-scale analysis of medical records of hospitals in China and reported high accuracy in prediction through symptoms [2]. Besides this, many researchers had tested SVM and ANNs, which were conventionally image classification algorithms. They also reported a high value of accuracy [4].

Until now, our work has focused on the training of our algorithm, with the use of medical data available openly. The algorithm has not shown the required accuracy and will need to be trained further. The other module we have built is the GUI. We built a web-based GUI in flask, an open source python framework. These two modules are the endpoints of the project and building them first allows the ones in the middle to be built with convenience.

The comparison between existing results and actual results show a gap in accuracy that has to be closed. However, we were able to achieve more versatility, which was probably the reason that the algorithm was less accurate in the first place.

**TABLE OF C O N T E N T S (for Agile Methodology)**

* + - * Certificate i
      * Industry Certificate(If applicable) ii
      * ACKNOWLEDGEMENTS iii
      * Abstract iv
      * List of Figures v
      * List of Tables vi
      * Abbreviations and symbols vii

**Chapter No. Topic Pg. No.**

**Chapter1 Overview 01**

**1.1 Introduction**

1.2 Background

1.3 Importance of the Project

1.4 Perspective of stakeholders and customers

1.5 Objectives and Scope of the project

**1.6 Summary**

**Chapter2 Literature Survey & Proposed Work (Phase wise) 05**

**2.1 Introduction**

**2.2 Literature Survey Table**

2.3 Problem definition (Phase wise)

2.4 Feasibility Study

2.5 Methodology used

2.5.1 Scrum/XP/Agile

2.5.2 Customer interaction details

**2.6 Summary**

**Chapter3 Analysis and Planning**

**3.1 Introduction**

3.2 Product Backlog or Sprint backlog

3.3 Project planning (Resources, Tools used, etc.)

3.4 Scheduling (Time line chart or Gantt chart) according to sprint backlog

**3.5 Summary**

**Chapter4 Design and Implementation**

4.1 DFD (if applicable) or Kanban Chart

4.2 Block Diagram (if applicable)

4.3 Flow Chart (if applicable)

4.4 UML (if applicable)

4.5 GUI screenshot

4.6 Database screenshot

**Chapter 5 Results & Discussion**

5.1Actual Results

a. Outputs (sprint wise)

b. Outcomes

c. Discussion of the results

5.2 Future Scope (further phases)

5.3 Testing

5.4 Deployment

**Chapter 6 Conclusion**

6.1 Conclusion

**References:**

Style of list in references of some standards are as below;

**[1] Text book references**

**[2] Journal references**

**[3] Web references**

**IEEE standard references format**

[1] J.F.Curtis,(Ed.),*ProcessesandDisordersofHumanComm-unication.*NewYork: Harper and Row, 1978.

[2] J.Schroeterand,M.M.Sondhi,“Techniquesforestimatingvocal-tractshapesfromthe

speechsignal,”*IEEE Trans. Speech Audio Process.*, vol. 2, no. 1, pp. 133–150, 1994.

[3] J. M.Pardo,“Vocal tract shape analysis for children,”in *Proc. IEEE Int. Conf.*

*Acoust., Speech, SignalP*

**APPENDIX:**

**[A] Attach copies of Literature survey papers**

**[B] Plagiarism check report:**

1 page plagiarism self- evaluation report. (Use Quetext or Plagscan for generating report)

**[C] Complete research paper with results**

**[D] Graduate Attributes and its mapping with the project**

**TABLE OF C O N T E N T S (for Waterfall Model)**

* + - * Certificate i
      * Industry Certificate(If applicable) ii
      * ACKNOWLEDGEMENTS iii
      * Abstract iv
      * List of Figures v
      * List of Tables vi
      * Abbreviations and symbols vii

**ChapterNo. Topic Pg.No.**

**Chapter1 Overview 01**

**1.1 Introduction**

1.2 Background

1.3ImportanceoftheProject

1.4Motivation

1.5 Objectives and Scopeoftheproject

**1.6 Summary**

**Chapter2 Literature Survey&ProposedWork 05**

**2.1 Introduction**

**2.2 Literature Survey Table**

2.3Problemdefinition (Phase wise)

2.4Features of the project

2.5Methodology used

**2.6 Summary**

**Chapter3 Analysis and Planning**

**3.1 Introduction**

3.2FeasibilityStudy

3.3Projectplanning (Resources, Tools used, etc.)

3.4Scheduling(Timelinechart or Gantt chart)

**3.5 Summary**

**Chapter4 Design Requirements**

4.1 DFD (if applicable)

4.2 Block Diagram (if applicable)

4.3 Flow Chart (if applicable)

4.4 UML (if applicable)

4.5 GUI Design (Screenshots)

**Chapter 5 Results& Discussion**

5.1Actual Results

a. Outputs(Output of the project only)

b. Outcomes

c. Discussion of the results

5.2 Future Scope

**Chapter 6Conclusion**

6.1 Conclusion

**References:**

Styleoflistinreferencesofsomestandards are as below;

**[1] Text book references**

**[2] Journal references**

**IEEE standard**

[1]J.F.Curtis,(Ed.),*ProcessesandDisordersofHumanComm-unication.*NewYork: Harper and Row, 1978.

[2]J.SchroeterandM.M.Sondhi,“Techniquesforestimatingvocal-tractshapesfromthe

speechsignal,”*IEEE Trans. Speech Audio Process.*, vol. 2, no. 1, pp. 133–150, 1994.

[3]J. M.Pardo,“Vocal tract shape analysis for children,”in *Proc. IEEE Int. Conf.*

*Acoust., Speech, SignalP*

**[3] Web references**

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1 page plagiarism self- evaluation report. (Use Quetext or Plagscan for generating report)

**[C] Complete research paper with results**

**[D] Graduate Attributes and its mapping with the project**

**Guidelines for preparation of Thesis/Dissertations/Project**

**Reports**

**Preamble:**

The content of the Thesis/Dissertation/Project report (here in after called as report) must be paid utmost attention, which is being submitted in partial fulfillment of the requirements of the Doctoral, Post-graduation and Under-graduation degrees respectively. A Standard format is equally important and may be prescribed by the University of Mumbai, which helps in bringing uniformity in all the reports and improves aesthetics of report. The same format shall also be followed in preparation of the final soft copies to be submitted to the library.

**1. Organization of the Thesis/Dissertation/Project report**

This report shall be presented in a number of chapters, starting with Introduction and ending with Conclusions. It shall be ensured that all the chapters will have a precise title reflecting the contents of the chapter. A chapter can be subdivided into sections, sub-sections and so on as to present the content discretely and with due emphasis.

The report may be divided into two or more parts, each with an appropriate title, when the work comprises two or more mutually independent investigations. However, the numbering of chapters will be continuous right through, for example Part1 may comprise Chapters 2•4,Part Two,Chapters5•8.

**1.1Introduction:**

The title of Chapter1 shall be Introduction. It shall justify and highlight the problem proposed, define the topic and explain the aim and scope of the work presented in the report. It may also highlight the significant contributions from the investigation.

**1.2ReviewofLiterature:**

This shall normally formChapter2andshallpresentacriticalappraisalofthepreviouswork published in the literature pertaining to the topic of the investigation. The extent and emphasis of the chapter shalldepend on the natureof theinvestigation.

**1.3ReportonthePresentInvestigation:**

Thereporting ontheinvestigationshallbepresentedinoneormorechapterswithappropriate chaptertitles.

 Dueimportanceshallbegiventoexperimentalsetups,proceduresadopted,techniques developed, methodologies developed andadopted.

 Whileimportantderivations/formulaeshouldnormallybepresentedinthetextof these chapters,extensive andlongtreatments,copiousdetailsandtediousinformation, detailedresultsintabularandgraphicalformsmay be presentedinAppendices. Representativedataintable andfiguresmay,however,beincluded inappropriate chapters.

 Figuresandtablesshouldbepresentedimmediatelyfollowingtheirfirstmentionin thetext. Shorttablesandfigures(say,lessthanhalfthewritingareaofthepage) shouldbepresentedwithinthetext,whilelargetableandfiguresmay bepresentedon separatepages.

 Equationsshouldformseparatelineswithappropriateparagraphseparationaboveand below the equation line,with equation numbers flushedto the right.

**1.4ResultsandDiscussions:**

Thisshallformthepenultimatechapterofthereportandshallincludeathoroughevaluation oftheinvestigationcarriedoutandbring outthecontributionsfromthestudy. Thediscussion shalllogically leadtoinferencesandconclusionsaswellasscopeforpossiblefurtherfuture work.

**1.5Conclusions:**

Thiswillbethefinalchapterofthereport. Abriefreportoftheworkcarriedoutshallform the firstpart of the Chapter. Conclusionsderived fromthe logicalanalysispresented inthe ResultsandDiscussionsChaptershallbepresentedandclearly enumerated,eachpointstated separately. Scope forfuturework should bestated lucidlyin thelast part of the chapter.

**1.6Appendix:**

Detailedinformation,lengthy derivations,rawexperimentalobservationsetc.aretobe presentedintheseparateappendices, which shall benumbered in RomanCapitals (e.g. “AppendixI”). Since reference canbe drawntopublished/unpublishedliterature inthe appendices theseshould precede the “Literature Cited”section.

**1.7LiteratureCited:**

This should follow the Appendices, if any, otherwise the Conclusions chapter. The candidatesshallfollowthestyleofcitationandstyleoflistinginoneofthestandardjournals in the subject area consistently throughout his/her report, for example, IEEE in the DepartmentofElectricalEngineering, ASMEinDepartmentofMechanicalEngineering. However,thenamesofalltheauthorsalong withtheirinitialsandthefulltitleofthe article/monogram/book etc. havetobegiven inadditiontothe journals/publishers, volume, number, pages(s) andyear ofpublication.

Citation from websites should include the names(s) of author(s) (including the initials), full title of the article, website reference and when last accessed. Referencetopersonalcommunications,similarly,shallincludetheauthor,title ofthe communication (if any) and date ofreceipt.

**1.7.1Publicationsbythecandidate:**

Articles,technicalnotesetc.onthetopicofthereportpublishedby thecandidatemay be separatelylistedaftertheliteraturecited. Thismayalsobeincludedinthecontents. The candidates mayalso include reprints of his/her publications after theliterature citation.

**1.8Acknowledgements:**

Theacknowledgments bythecandidateshall follow thecitation ofliterature, signed by him/her, with date.

**2.0 Thesis/Dissertations/ProjectReports Format**

**2.1Paper:**

Thereportshallbeprinted/xeroxed onwhite bond paper,whiteness 95%or above, weight70gramormorepersquaremeter.ThesizeofthepapershallbestandardA4;height

297 mm, width 210 mm.

**2.2Type•Setting,TextProcessingandPrinting:**

Thetextshallbeprintedonsingleside ofapageemploying laserjetorInkjetprinter,thetext havingbeen processed usingastandardtext processor. Thestandardfont shallbe**TimesNew Roman**of**12 pts** with**1.5 linespacing**.

**2.2.1Page Format:**

ThePrinted Sheets shallhavethe followingwritten areaand margins: Top Margin : 15 mm

Head Height : 3 mm Head Separation : 12 mm Bottom Margin : 22 mm Footer : 3 mm Foot Separation : 10 mm Left Margin : 30 mm Right Margin : 20 mm Text Height : 245 mm Text Width : 160 mm

When header is not usedthe top margin shallbe30 mm.

**2.2.2Pagination:**

Pagenumbering inthetextofthereportshallbeHindu-Arabicnumeralsatthecenter ofthe footer. Page number “1”for thefirstpage of theIntroductionchapter shallnotappear in print; onlythesecondpagewill bearthe number “2”.Thesubsequentchapters shallbegin onafresh page. Pagination for pages before the Introduction chapter shall be in lower case Roman numerals, e.g., “iv”.

**2.2.3Header:**

Whentheheader styleischosen,theheader canhave theChapter number and Sectionnumber (e.g.,Chapter 2, Section3) onevennumbered page headersandChaptertitle orSectiontitle on the odd numbered page header.

**2.2.4Paragraph format:**

Verticalspacebetweenparagraphsshall be about2.5line spacing.Thefirstline ofeach paragraphshould normally beindentedby fivecharactersor12mm. A candidate may, however, choose not to indent if s/he has provided sufficientparagraph separation. Aparagraphshouldnormally comprisemorethanoneline. Asinglelineofaparagraphshall notbeleftatthetoporbottomofapage.Thewordattherightendofthefirstlineofapage orparagraph should, as far as possible, not be hyphenated.

**2.3ChapterandSectionFormat:**

**2.3.1Chapter:**

Eachchaptershallbeginonafreshpagewithanadditionaltopmarginofabout75mm. Chapternumber(inHindu•Arabic) andtitleshallbeprintedatthecenterofthelinein6mm fontsize(18pt)inboldfaceusingbothupperandlowercase(allcapitalsorsmallcapitals shallnotbeused). Averticalgapofabout12mm(spacing afterfontsize36withsingleline spacing)shallbeleftbetweentheChapternumber andChaptertitlelinesandbetween chaptertitleline and thefirst paragraph(sampleisgivenas specimen ‘A’).

**2.3.2Sectionsand Sub•sections:**

Achapter canbedividedintoSections,Sub•sections andSub-subSectionssoastopresent different concepts separately. Sections and sub•sections can be numbered using decimal points, e.g. 2.2 for the second section in Chapter 2 and 2.3.4 for the fourth Sub•section inthirdSectionofChapter2. Chapters,SectionsandSubsectionsshallbe included inthe contents with page numbers flushed to the right. Further subsections need not be numbered or includedin the contents.

TheSectionandSub•Sectiontitlesalongwiththeirnumbersin5and4mm(16and14pt)

fonts,respectively,inboldfaceshallbeflushedtotheleft(notcentered)with15mmspace

above and below theselines.

Infurther subdivisions character size of 3and3.5withboldface,smallcaps,allcapsand italicsmaybeusedforthetitlesflushedleftorcentered. Theseshallnotfeatureinthe contents.

**2.3.3Table/FigureFormat:**

Tablesandfiguresshouldbepresentedinportraitstyleasfaraspossible. Smallsizetable andfigures(lessthanhalfofwriting areaofapage)shouldbeincorporatedwithinthetext, while larger ones may be presented on separate pages. Table and figures shall be numberedchapter•wise. Forexample,thefourthfigureinchapter 5willbear thenumber Figure5.4 orFig5.4.

Tablenumberandtitlewillbeplacedabovethetablewhilethefigurenumberandcaption willbelocatedbelowthefigure. Referencefor TableandFiguresreproducedfromelsewhere shallbe cited in thelast and separatelinein thetableand figurecaption.

**3.0 AuxiliaryFormat**

**3.1Binding:**

The finalhardboundcopiestobe submittedafter the viva-voce examinationwillbeaccepted during the submission of thesis/dissertation/ project report withblackcolour.

**3.2FrontCovers:**

The front covers shallcontain the followingdetails:

 Fulltitleofthesisin6mm22point'ssizefontproperlycenteredandpositionedatthe top.

 Fullnameofthecandidatein4.5mm15point'ssizefontproperlycenteredatthe middle ofthe page.

 A50mmdiareplicaoftheInstituteemblemfollowedbythenameofdepartment, nameof theInstitute andtheyear of submission,eachina separatelineandproperly centered and located at thebottom of page.

**3.2.1Lettering:**

All letteringshall beembossed in gold.

*3.2.2Boundback:*

The degree, the name of the candidate and the year of submission shall also be embossed on the bound (side) ingold.

**3.3BlankSheets:**

Inadditiontothewhitesheets(binding requirement)twowhitesheetsshallbeputatthe beginningand the end ofthe thesis.

**3.4TitleSheet:**

This shall be the first printed page of the reportand shall contain the submissionstatement: the Thesis/Dissertation/projectReport submitted in partial fulfillment of the requirementsof the Degree, Ph.D. /M.E./B.E.,the name andRoll No.of the candidate, name(s) of the Supervisor and Co•supervisor (s) (if any), Department,Institute andyear ofsubmission.

Sample copyof the'TitleSheet'is appended (Specimen 'B')

**3.5DedicationSheet:**

Ifthecandidateso desiress/hemay dedicateher/hisreport,whichstatementshallfollowthe titlepage. Ifincluded,thisshallformthepage1oftheauxiliary sheetsbutshallnothavea pagenumber.

**3.6ApprovalSheet:**

Intheabsenceofadedicationsheetthiswillform thefirstpageandinthatcaseshallnothave apagenumber. Otherwise,thiswill bearthenumbertwoinRomanlowercase“ii”atthe centerof the footer. Thetop line shallbe:

1. ThesisApproval forPh.D.

2. Dissertation Approval for M.E.,

3. ProjectReport Approvalfor B.E,as the casemaybe.

TheApprovalSheetsaretobeincludedonly inthehardboundcopieswhicharesubmitted after thesuccessful Ph.D./M. E. /B. E. viva •voceexamination.

A sample copyof theApproval Sheet is appended(Specimen`C')

**3.7Abstract:**

The 500 word abstract shall highlight the important features of the thesis/dissertation/ project report and shall correspond to the electronic version to be submittedtotheLibraryforinclusioninthewebsite. TheAbstractinthethesis,however, shallhavetwomoreparts,namely,thelayoutofthethesisgivingabriefchapter• wise description of theworkand the keywords.

**3.8Contents,ListofFiguresandTables:**

The contentsshallfollowthe Abstractandshallenlistthe titlesof the chapters,sectionand sub•section using decimal notation, as in the text, with corresponding page numberagainstthem, flushedto the right.

Two separatelistsofFigurecaptionsand Table titlesalongwiththeirnumbers and correspondingpagenumbers againstthem shallfollow theContents.

**3.9AbbreviationNotationandNomenclature:**

Acompleteandcomprehensivelistof allabbreviations,notationsandnomenclatureincluding Greekalphabetswithsubscriptsandsuperscriptsshallbe provided after thelistof tables and figures. (As far as possible, generally accepted symbols and notation should be used).

Auxiliary pagefromdedication(ifany)toabbreviationsshallbenumberedusingRoman numeralsinlower case,whilethetextstarting fromtheIntroductionshallbeinHindu•Arabic. (The first pages in theboth the cases shall notbear apagenumber).

**3.10ADeclarationofAcademicHonestyandIntegrity:**

AdeclarationofAcademichonesty andintegrity isrequiredtobeincludedalongwithevery thesis/dissertation/projectreportaftertheapprovalsheet. Theformatofthisdeclarationis given in Specimen`D' attached.

**Chapter1**

**Introduction**

**1.1(Specimen‘A’)**

**1.1.1FormattingGuidelines**

**Chapter# References**

Styleof listingreferencesofsomestandards are as below;

**IEEE standard**

[1]J.F.Curtis,(Ed.),*ProcessesandDisordersofHumanComm-unication.*NewYork: Harper and Row, 1978.

[2]J.SchroeterandM.M.Sondhi,“Techniquesforestimatingvocal-tractshapesfromthe

speech signal,”*IEEE Trans. Speech Audio Process.*, vol. 2, no. 1, pp. 133–150, 1994.

**[3]**J. M.Pardo,“Vocal tract shape analysis for children,”in *Proc. IEEE Int. Conf.*

*Acoust., Speech, SignalP*