

Human Computer Interaction (Hindi mein)

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Human Centered AI for Autism Diagnosis

Lec43

[Sangeet] Namaskar. Aaj main Ashwini B. ke dwara kari gayi pariyojana ko prastut karne jaa rahi hoon ki kis prakaar se human centered AI ka prayog kar sakte hain Bhartiya bachhon mein autism ke nidaan ke liye. Chaliye shuru karte hain. Autism spectrum vikar ek neurodevelopmental condition hai jo samajik sampark mein kami aur do dohavdar vyavahar ke dwara pehchani jaati hai. Jaivik sanketon ki kami ke kaaran iska nidaan mata-pita ki report aur chikitsakon ke anubhav par nirbhar karta hai. Isse kaarya mein subjectivity aa jaati hai. Autism ka failav aur technology support ki zaroorat. San 2000 se autism mein 317% badhotri hui hai. CDC ke anusaar 36 mein se ek chhatra har varsh autistic hota hai. Bharat mein yeh sankhya ek mein 82 mein se ek hai. Autism ke badhte prachar ke kaaran health care industry par aur bojh pad raha hai. Isiliye technology support ki aavashyakta hai. Abhi tak AI shiksha, manoranjan, yatra, prashasan aadi kshetron mein istemal ho chuka hai. Health care ke sector mein bhi yeh laabhdayak hai. Mental health yaani ki maansik swasthya kshetra mein AI ka prayog avsaad yaani ki depression, chinta yaani ki anxiety, autism aadi jaisi vibhinn neurodevelopmental sthitiyon ko pehchanne mein kar sakte hain. Anusandhan ki kamiyaan jaankar humne apne adhyayan ke uddeshya tay karein. Sabse pehla abhi tak ke anusandhan globally north mein sthit the. Isiliye Bharat jaise desh ki samajik, aarthik aur saanskritik paristhitiyon par dhyan nahi diya gaya. Isi disha mein hum ab AI assist system ki swikriti sansadhan seemit settings yaani ki resource constraint environment mein dekhna chahte the. Is disha mein humne special educators aur bachhon ki rai jaani AI assisted systems ka upyog karne ke liye. Doosra humne yeh pehchana ki vyavahar ka analysis vyavahar ko dhang se dekhna padega bachhe mein autism pehchanne ke liye. Us disha mein humne ML ki do algorithms banayi. Pehla jo chehre ke bhaav pehchanegi. Doosra jo baat karne ke tarike se batayegi ki autistic ke kitna pratishat autistic hai. Toh isiliye isko humne kaha hai multimodal. Phir aise AI system ko apne Bharat jaise desh mein istemal karne mein kya chunautiyan aa sakti hai? Usko pehchanne ke liye humne ek pilot study kari Bharat mein. Toh sabse pehle swikriti of hum jaanna chahte hain ki AI developmental system ki swikriti kaisi hai Bharat jaise desh mein. Toh humne jo bhi experiments karein woh saare Institutional Review Board ke dwara allowed hain. Toh sabse pehle hum special educators yaani ki vishesh shikshakon ke drishtikon ko jaanna chahte the. Jiske liye humne ek adhyayan kara. Adhyayan ke mukhya prashn yeh the ki abhi technology ka kya hastakshep hai autism pehchanne ki prakriya mein? Doosra special educators yaani ki vishesh shikshakon ke anusaar social robots

ka istemal ASD ke pehchan ke liye usmein kya benefits ho sakte hain? Aur kya challenges ho sakte hain? Kya laabh hain aur kya kamiyaan ho sakti hain? Teesra ki social robot jaise naye system ko integrate ko ke samayojan ke liye kya-kya chunautiyan aa sakti hain aur kya special educators ki rai hain ismein? Toh humne 25 special educator se baat kari. Unhein ek video prastuti dikhayi jismein ek bachha robot se baat kar raha hai. Alag-alag kaarya ho rahe hain. Phir unki ek semi-structured interview li aur panel discussion kari. Toh is adhyayan par adhyayan ke baad hamare kuch mukhya nishkarsh saamne aaye. Sabse pehla kis ki social robots special educators ke dainik bojh ko kam kar sakte hain aur bhavatmak samarthan unhein pradaan kar sakte hain. Bhavnatmak samarthan yaani ki emotional support de sakte hain. Special educators ne yeh bhi kaha ki yeh machinein mehngi hain aur agar kabhi toot jaati hain toh unhein apne salary mein se uske liye paisa dena padega. Toh uski accountability responsibility uski zimmedari kaun lega? Agla ki abhi ke jo abhi ke jo system hai usmein robot ko seemit karne ke liye unhein naye kadam uthane padenge toh unke liye woh thoda sa bojhdayak ho sakta hai. Phir unhein darr tha ki kahin yeh robot unki jagah na le le. But humne unhein samjhaya yeh sirf bachhon ke hit ke liye hai. Yeh sirf unki sahayata sahayata purvak hai na ki unki jagah lene ke liye hai. In sab chunautiyon ke baawjood bhi bachhon ke hit ke liye ve yeh poora system apnane ke liye samaksh the. Toh in nishkarshon se humne paaya kifayati yaani ki cost effective, robust social robots banane ki zaroorat hai. Robust yaani ki mazboot. Aur inko banane ke baad inki integration yaani ki inka samayojan aasani se hona chahiye abhi ke paristhitiyon mein aur humne yeh jaana ki pratyek bachha jiska autism hai woh alag hai toh hamare jo kaarya hone chahiye woh har ek bachhe ki zarooraton ko poora karna chahiye. Bharat jaise desh mein saanskritik upyogita ka abhav hai abhi ke systems mein toh isiliye Bharat jaise desh ki saanskritik vibhinnata ke prati sanvedansheelta ki zaroorat hai aur special educators ne yeh bhi bataya tha ki unko darr hai ki yeh unka unki jagah na le le. Isiliye upyukt naitiyon aur naitik disha nirdeshon ki bhi unhone maang kari. Aur naye system ke se adopt hone ke liye unhone training aur support ki bhi maang kari. Phir hum bachhon ki rai jaanna chahte the AI systems ka istemal ke istemal ke baare mein. Jiske liye humne ek adhyayan kiya jiska mool prashn yeh tha ki typically developing bachhe yaani ki jinhein autism nahi hai unki kya rai hai? Robot based system, robots based systems ke dwara autism diagnosis autism ke adhyayan ke liye autism ke nidaan ke liye toh humne 10 bhagidar bhagidar liye jismein aath female thi do male the. Teen se chhah unki umra thi. Robot humne Cosmos use kiya. Yeh poora adhyayan teen bhaagon mein hua. Introduction response introduction jismein bachhon ko robot aur kaarya se parichit kiya gaya. Doosra satra response to name task jahan ek samajik sanket ke saath bachhon ko naam ka uttar dena tha robot ko aur joint attention task yaani ki sanyukt dhyan kaarya jahan bachhe robot ke saath dhyan saajha karta hai. Is in sabhi karyon ka chayan AIIMS ke dwara viksit INDT ASD ke dwara kiya gaya tha aur ant mein humne mata-pita ki rai jaanne ke liye unse unke saath ek survey questionnaire bhi kiya. Toh humne yeh jaana ki nau mein se 10 bachhe kaarya ko poora kar paaye the. Yahan par is matrix mein jitna kam score jitna kam ank hai uska matlab unka dhyan zyada achha tha. Toh humne jaana ki nau mein se 10 bachhe kaarya poora kar paaye the aur aur humne unke eye contact ke dwara dekha ki kaafi bachhe robot ke saath robot ke saath attentive

the. Toh unka overall kaafi positive response tha. Robot assisted batchit mein. Ab multimodal behavioral analysis jiske liye humne do ML algorithms banayi. Ek jo chehre ke bhaav jaanta hai aur ek jo baat karne ke tarike se batayega ki autistic hai ki nahi. Toh isliye multimodal sabse pehle facial expression recognition chehre ke bhaav se hum batayenge autism hai ki nahi hai. Toh hamare paas Hindi speaking bachhon ka data bahut kam tha. Toh humein koi smart koi chatur tarike se ML model banana tha. Toh chehre ke bhaav aapke baare mein bahut kuch kehte hain. Isiliye hum logon ne chehron ke bhaav ko jaanne ke baare mein socha. Toh jo hamara model hai woh hai source free multi-source transfer learning model. Source free kyun kaha gaya hai? Kyunki hamare paas Bhartiya bachhe jinhein autism hai ya jinhein autism nahi hai uska data kam hai. Toh isliye hum milti-julti domain se data lene ki koshish karenge. But jab hum woh data lenge uske hum model ko dekhenge ki us data se kuch model train hua hai aur us model ke parameters ko hum apne task mein istemal karenge. Us model ki knowledge ko hum apne task mein istemal karenge jo milti-julti domain se aayega. Toh is milti-julti domain ka jo data set hai woh humein apne task ke liye model train karte waqt nahi milega. Isliye humne isko kaha hai source free ki source ka jo data set hai woh humein nahi pata model train karte waqt humein sirf parameters yaani ki knowledge jo usne gain kari hai is domain se train hokar woh milegi. Isliye source free multi-source kyunki hum milti-julti do-teen domains lenge. Un sabka knowledge use karenge aur transfer learning kyunki hum unki knowledge ko apne DL model mein istemal kar rahe hain. Isliye transfer learning on a related task milte-julte task pe hum log similar domains ka knowledge use kar sakte hain. Toh isse kya hoga? Hamara model zyada generalized hoga. New domain mein better perform karega. Overfit nahi karega. Also jo baaki domain hai unki privacy maintain rahegi. Toh hum propose karte hain ek multivariant maximal correlation analysis jismein ek assemble banate hain hum pre-trained source network ka. Yeh saare ke source networks pre-trained the. Inki sirf knowledge use karenge. Train apne DL model ko train karte waqt in parameters ko hum nahi badlenge. Yeh parameters frozen ho jayenge. Ab humne isko multivariant maximal correlation kyun kaha hai? Hum chahte hain ki apni domain aur apne actual task ki beech mein correlation maximize kar sakein ki unki ki woh jo zyada jo task se zyada milti hai domain uski contribution hamare final model mein zyada ho. Toh isiliye humne kaha hai maximum correlation analysis. Jo bhi domain zyada task se related hai uski contribution output mein zyada honi chahiye. Aur kyunki hum ab bahut saari domain le rahe hain toh unke output se ek assemble hi toh bana rahe hain. Un sabko ek saath parallel mein chala rahe hain. Aur jo output aayega woh in sabka assemble hai. Toh iska poora naam humne rakh diya multi-source. Bahut saare source hain. Transfer learning. Unki knowledge ko hum log apne model mein le aa rahe hain. Transfer kar rahe hain. Transfer learning aur jo hamara method hai jiske through hum saare data ko ek saath assemble kar rahe hain woh hai multivariant correlation analysis yaani ki MCA. Toh ab model samajhte hain. Toh chaliye model ka architecture samajhte hain. Kisi bhi deep learning model mein do bhaag hote hain. Ek jo data ko feature se map karta hai. Data ko features par map karta hai. Aur doosra jo mapped feature se output tak leke jaata hai. Aur yahan pe dono bhaag hain. Toh sabse pehle x jo hai woh ek data set sample hai. Yeh hamare sources hain. f_s jo hai woh feature function hai har ek source ke liye. s_1 ke liye, s_2 ke

liye, s_n ke liye. n hamare domains hain. n hamare n domains hain ismein. Aur jo f_n f_s hai woh hai feature function. Jo g_s hai woh hai classification function aur jo hamara ρ hai woh hai correlation coefficient. Toh kya ho raha hai lock ka matlab hai ki frozen hai iske parameters. Yeh model kuch bhi ho sakta hai LSTM ho sakta hai. ResNet ho sakta hai. Train hua tha S1 data S1 data set pe jo S1 ek domain hai. Humne uske humne poora model utha liya. Humne data set chhod diya toh source free ho gaya. Phir GS1 jo hai woh classification function hai. FS1 ne feature extract karein purane source free model ke. Aur phir woh GS1 mein gaye hain jo hamara classification function hai jo learnable hai. f_{s1} h_{s1} learnable nahi hai. Frozen hai. GS1 jo hai woh learnable hai. Woh hai hamara label projection function ya classification head. Dhyan se dekha jaaye ki yeh x aaya tha aur f_{s1} jo hai usmein bhi x hi hai. But yahan pe y hai. y jo hai hamari target level space hai. Yaani ki jaise happy, sad, fear, surprise, anger yeh ek vector hai. Aur jo output aayega woh hoga logits. Yaani ki har ek class ki probability kya hai? Toh jiski sabse zyada probability hogi hum keh denge maan lo surprise ki probability hogi 0.7 baaki sabki kuch 0 kam kam hogi 0.01 kuch bhi ho sakti hai toh hum keh denge yeh surprise class ko belong karta hai ka part hai. Toh yeh ab humne har ek domain har ek model ke liye kara hai aur multivariant maximal correlation ke dwara humne source domain ko target domain mein maximize ko maximum correlate kiya hai. Jo f_{s1} hai, f_{s2} hai yaani ki correlation coefficient woh bhi trainable hai. Woh bhi is pe nirbhar karte hain ki source ke domain aur task domain mein target domain mein kitna kitne similar hain. Toh jitne zyada similar honge utna zyada ρ hoga. Toh agar is model ko main summarize karoon dobara toh ismein input data aaya X_T woh gaya FSI ke through, FS har ek FS ke through har ek feature function ke through aur yahan se source specific features mil gaye. Us source ke specific features hamare data set mein kya the woh mil gaye. Phir HS1 jo hai HSI jo hai woh ek bas ek hidden layer hai. Woh bas yeh hai ki saare features ko same latent space mein leke aa jaaye. Align features same latent space aa jaaye. Uske baad hamara MMC block aata hai. MCA block aata hai. Multivariant MMC block aata hai. Multivariant maximal correlation analysis ke liye hai. Jahan pe hum saare GSI learn karte hain for each source har source ke liye jismein saare GSI maximally correlated hote hain. Such that jo domain sabse zyada related hai uska ρ S sabse zyada ho aur jo hamara output hota hai woh hota hai logits har ek class ki kitni probability hai toh yeh tha hamara architecture. Toh ab humne experimentation ke liye ek hi model use kara homogenous model use kara aur alag-alag domains ka istemal kara. Alag-alag data set ka istemal kara. Toh maan lo humne apni target domain ko F bana diya yaani ki FER2013 aur apne source ko RCJ bana diya. R yaani ki RAF-DB, J yaani ki JAFFE aur C yaani ki CK+. Aise-aise humne permutations saari istemal kari aur dekha ki hamara best response aa raha hai. Jab hum humne homogenous model use kiya. Yaani ki har ek domain mein ek hi model use kara hai. Ek hi model ka istemal kiya hai. Jab humne sab mein ResNet ka istemal kara toh hamara maximum average aa raha hai. Average toh LeNet mein bhi achha hai. But humne finally toh humne ab ResNet ka prayog kiya. Phir humne CFEE-D data set yaani ki ek lab created data set hai that stands for Children Facial Expression Dataset jo ek Indian bachhon par kendrit data set hai. Us pe bhi hamari accuracy kaafi achhi aa rahi thi. But dhyan rahe classification ke task mein hum log accuracy ke saath precision recall bhi dekhte

hain. Phir humne aise hi ASD-FER data set pe bhi istemal kara aur 40% maximum accuracy hamari ResNet ke saath hi aa rahi thi. LeNet mein bhi comparable accuracy hai. Toh humne yeh jaana ki ab hum jaanna chahte hain ki hamara model jo tha jo humne sparse data set data settings mein apna model define kiya. Kya woh achha hai? Toh humne paaya ki 20 just 20 data points use karne pe 20 hamara jo domain specific task related data set tha sirf unke 20 data points use karne pe bhi istemal karne pe bhi achhi khaasi accuracy aa rahi hai. Humne ek elbow hit kar di thi. Phir chahe hum usko 100 kar dein, 500 kar dein toh accuracy mein zyada antar nahi hai. Kya? 85 se 87 87 88 itni hi ho rahi hai. 500 karne pe 90 pahunch rahi hai. 90 ke upar jaa rahi hai. Toh humne jaana ki hamara model achha hai. Aur yeh bhi jaana ki jitna zyada task related hai domain task se domain task jitna zyada target task se related hai utni zyada uska rho hai. Coefficient, correlation coefficient hai. Jo ki expected bhi tha. Isliye jo hamara model hai woh ek assemble hai. Jo hamara output hai har ek class ka woh aisa hoga koi $\rho * g * f$ har ek s ke liye jo hamara output hoga har ek class ke liye. Toh isiliye isko ek assemble bola hai. Toh humne shikshakon ka jaan liya. Humne shikshakon ke baare mein jaan liya. Humne chhatron ke baare mein jaan liya apne do adhyayan ke dwara. Aur phir humne ab behavioral model aapko do ek facial recognition ke liye ek behavioral model bata diya. Doosra ML model baat karne pe tarike pe nirbhar hai. Kyunki humne kaha tha ki vyavahar ko autism ke nidaan ke liye dhyan mein rakhna chahiye. Toh hamara doosra model baat karne ke tarike par nirbhar hai. Toh abhi tak jo saara dhyan kendrit tha logon ka woh tha prosodic aur acoustic features yaani ki baat karne ke pitch par ya kisi cheez ko kaise kaha gaya hai us par nirbhar tha. Toh humne hypothesis yeh diya ki dhyan semantic aur pragmatic features pe bhi dena chahiye. Semantic matlab sach mein kya bola gaya hai? Literally kya kaha gaya hai? What is said? Literally what is said and pragmatic yaani ki kya matlab hai uska? What is meant by them? Jo ki context specific hai. Yaani ki sandarbh jaagruk hai. Semantic aur pragmatic features pe bhi dhyan dena chahiye. Abhi tak sirf hamara dhyan acoustic and linguistic bhaag pe tha. Aur doosra jaise ki vishesh shikshakon ne bhi kaha tha ki pratyek bachha autistic jo hai uska baat karne ka tarika alag hoga. Uske baat karne ke tarike mein diversity hogi aur jo hamari saanskritik settings hain India ki uska bhi kuch uski bhi kuch alag zarooratein ho sakti hain. Toh jaisa ki maine bataya ki humne jaana semantic aur pragmatic yaani ki linguistic features pe bhi dhyan dena chahiye. Acoustic features ke saath ASD aur typically developing bachhon mein antar karne ke liye. Toh humne pehle in features ko Hindi language mein dhoondha phir uska cross linguistic analysis kiya. Matlab phir English mein bhi dhoondha. Toh hum jaanna chahte the ki dono mein antar hai kya? English aur Hindi mein in features acoustic aur linguistic features mein kuch antar hai kya? Toh English ke liye toh kaafi data set available hai. Jaise main aapko bata hi chuki hoon. Kaafi uplabdh hai data set kyunki yeh north par zyada sthit hai study. Hindi data set humein khud collect karna pada jiske liye humne adhyayan kara aur aath diagnostic activities jo phir se AIIMS ke dwara INDT ASD ke dwara chayan ki gayi thi. Jaise ki bhaav kaise ho bhaav kaise badal rahe hain bachhon ke koi kisi ki na kisi ka naatak karna batchit karna naam ko naam pe respond karna haath milana, hand haath uthana aisi cheezein. Toh humne is chayan mein typically developing aur 15 autistic bachhe liye humne umra chaar se 14 varsh rakhi autistic ke liye taaki unki maukhhik kshamataon

ko hum naap sake typically developing bachhon ke saath aur female aur male count 12 3 aur 10 aath the. Toh ab baat karne ka jo ML model tha woh kuch is prakaar tha ki bachha aur interviewer baat kar raha hai. Uske speech signal ko humne bheja. Do parts mein divide kara. Do hisson mein divide kara. Do hisson mein vibhaga humne. Pehla jo sirf audio gayi doosra transcript yaani ki subtitles jo shabd hain woh gaye aur hamara jo feature set tha usmein acoustic toh humne dekha hi. Uske saath-saath humne linguistic bhi dekha jismein semantic parameter aur pragmatic features aa jaate hain ki kis baat ka ki shabdon ka arth kya hai? Literal arth kya hai? Aur shabdon ko kis context mein istemal kara gaya hai? Toh usmein arth kya hai? Aur uske according us par humne ek classifier chalaya aur ASD ya typical developing hai woh humne prediction kari. Yeh kuch features hain unke baare mein description hai ki humne kaun se features yahan pe istemal karein hain. Toh results mein humne paaya ki jab hum saare features istemal karenge tabhi hamari accuracy, precision, recall, F1 score sabse zyada aaya. Toh jaise ki maine kaha tha ki classification ke kaarya mein sirf accuracy par hai par hum apna poorra nirbhar nahi kar sakte hain. Humein precision precision recall matlab ki cross class precision recall F-score us pe dekhna padta hai. Toh precision ka agar formula bolein not map precision. Agar precision ka formula bolein toh that is true positives / true positives plus false positives. True positives matlab kitne actually mein autistic the aur autistic predict karein aur false positives matlab kitne jo typically developing the unko bhi humne autistic predict kar diya aur recall yaani ki true positives kitne actually mein autistic the aur autistic humne bataye hain upon true positives plus false negatives yaani ki jo autistic the unko humne typically developing bata diya. Aur F1 score toh bas HM hota hai. Harmonic mean hota hai in dono ka precision aur recall ka and recall. Aur humne yeh bhi paaya ki linguistic aur acoustic features agar dono istemal karein toh random forest algorithm mein sabse zyada accuracy aati hai. Hamara jo base classifier tha woh tha bas majority classifier. Yaani ki ASD mein agar chhah mein se 10 baar aaya aur typical developing chaar mein se 10 baar aaya toh usko ASD keh do. Iska matlab hota hai majority classifier. Usmein 57% aur linguistic aur acoustic features ko istemal karke 91.3% accuracy thi. Phir humne SHAP analysis use kara istemal kara English aur Hindi ke features ko compare karne ke liye. Toh humne yeh paaya ki dono bhashaon ke acoustic aur linguistic features alag-alag hain. Kyunki dono bhashaon ko kehne ka baat ko deliver karne ka tarika alag hai. Jaise ki English shabdon ke kram aur kaun se shabd istemal kare gaye hain us pe zyada nirbhar karti hai. Aur Hindi zyada flexible hai shabdon ke kram par aur zyada inflections par nirbhar karti hai. Jaana ki Hindi aur English ke acoustic features alag hain. Hindi shabdon ke chayan shabdon ki choice kaun se shabd istemal kare gaye hain aur shabdon ka kram kya hai us par nirbhar karti hai English aur jo Hindi hai woh zyada flexible hai shabdon ke chayan shabdon ke chayan par ya shabdon ke kram par aur zyada nirbhar karti hai inflections yaani ki bhasha ke utaar-chadhav par. Doosra humne yeh humne yeh jaana ki age aur verbal ability par nirbhar karta hai ki bachha kaise baat kar raha hai. Toh pratyek bachhe ki baat karne ke tarike pe hamara autistic ka autism ka chayan nirbhar karta hai. Toh humne Hindi bhasha ko English ke saath compare kiya SHAP analysis ke through SHAP analysis ke dwara aur humne jaana ki dono ke acoustic features mein kaafi vibhinnata hai. Kyunki dono mein vyakaranik dono ka vyakaranik sancharan yaani ki

grammatical structure aur bhashai visheshtayein. Bhashai visheshta yaani ki linguistic characters alag hain. Jaise ki angrezi shabdon ke chayan par yaani ki choice of words aur shabdon ke kram par zyada nirbhar karti hai. Aur Hindi more flexible hai shabdon ke kram pe aur zyada nirbhar karti hai inflections yaani ki bhasha ke utaar-chadhav par. Toh isiliye alag bhasha ke liye alag system hone chahiye. Alag model hone chahiye. Alag model train hone chahiye jo hum apne adhyayan ke through prove karna chahte hain. Ab hum apne poore adhyayan ko validate karne ke liye ek aur pilot study karenge jismein wahi do multimodal behavior analysis hoga. Chehre ke bhaag aur baat karne ka tarika robot mere AI system ke dwara. Toh is adhyayan mein 21 pratyogi the jismein nau ASD waale the aur 12 typically developing the almost aadhe-aadhe. Male aur female ka ratio 7 se 14 tha aur age bhi chaar se 14 li gayi thi. Is baar humne Nao robot use kiya tha. Pichli baar humne Cosmos robot use kiya tha. Diagnostic tools yaani ki jo jo activities thi woh humne AIIMS ke dwara viksit INDT ASD mein ASD se chayan ki gayi thi. Wahi baat karo naam ka response do. Kisi song ko imitate karo. Toh humne yeh do do groups mein kiya tha jismein pehle bachha human ke saath baat karega phir robot ke saath aur doosra pehle robot se baat karega phir human ke saath taaki koi dependence na ho ki pehle robot se baat kar li toh human ke saath kam interaction hai. Toh ab hum ismein model ko is prakaar se istemal karenge ki video banayi gayi bachha aur expert aur expert yahan pe human ho sakta hai ya phir robot ho sakta hai. Uski dhvani ko aur transcript ko alag se humne apne feature set jo banaya tha acoustic aur linguistic udhar paas kara. Classifier ne bataya ASD ya typically developing hai aur jo video thi usko humne apne MSTL MCA model se paas kara jisne bataya ki behavior kya hai? Happy hai, sad hai, kya hai? Toh taaki zyada zyada badi report mil sake chikitsakon ko. Ek report ka udaharan yeh hai. Yahan par true yahan par predicted level hai ki model ne ASD bataya. True level bhi ASD hi tha is is case mein. Aur baaki features ke baare mein kuch-kuch percentage aur yeh hamari MSTL MCA model ke dwara probabilities jo percentage mein badal di gayi har ek class ki. Toh humne jaana ki human ka F1 score better tha, achha tha lekin kaafi comparable tha robot ke F1 score se. F1 score jo humne abhi discuss kiya tha ki it is HM of precision and recall. Toh yeh evidence hai. Yeh thos saboot hai ki hamara AI enabled robot assisted system autism ke chayan mein achha sahayak ho sakta hai. Kaafi sahayak ho sakta hai. Toh is adhyayan ke dwara humne ek AI mediated system diya. Autism Bhartiya bachhon mein autism pehchanne ke liye specifically jo Hindi bolte hain Hindi speaking children mein jo hamare teen uddeshya the humne un teeno ko satisfy kara ki yeh poora adhyayan abhi tak north par sthit tha. Toh humne global south, resource district settings India mein iski acceptance dekhi. Iski swikriti dekhi. Doosra humne yeh jaana ki behavioral analysis crucial hai. Bahut zaroori hai ASD ke nidaan ke liye. Jismein humne do aur woh bhi resource constraint settings, sparse data set settings mein humne do ML algorithms di jo ki thi FER facial recognition system ke liye recognition ke liye aur speech analysis ke liye aur apne is poore chayan ko validate karne ke liye humne ek aur pilot study kari jisse humne bharpoor jaana ki hamara model doctors ke liye kaafi sahayak ho sakta hai. Toh abhi tak poora ka poora jo poora ka poora diagnostic prakriya observations aur parent reporting par nirbhar thi. Chahe chikitsakon ki observations aur parent reporting par nirbhar thi. Kaafi subjectivity thi. Toh ab AI system ke dwara yeh kaafi reliable ban

sakte hain aur health care ke sector mein clinicals ka clinicians ka burden kam kar sakte hain. Toh hamari pariyojana ek achha udaharan tha ki kis prakaar se HCI and AI ka prayog kar sakte hain badi chunautiyon ko badi chunautiyon ka samadhan nikalne ke liye. Hamare project ke baare mein aur jaanne ke liye aap yeh references dekh sakte hain. Dhanyavaad. [Sangeet]