Query: What are the variety of Multimodal and Multi-modular AI Approaches to Streamline Autism Diagnosis in Young Children?

Summary 1:

1 Scientific RepoRtS | (2020) 10:5014 | https://doi.org/10.1038/s41598-020-61213-w

www.nature.com/scientificreportsMulti-modular Ai Approach to

Streamline Autism Diagnosis in

Young children

Halim Abbas 1, ford Garberson 1, Stuart Liu-Mayo 1, eric Glover1* & Dennis p . Wall 2

Autism has become a pressing healthcare challenge. the instruments used to aid diagnosis are time

and labor expensive and require trained clinicians to administer, leading to long wait times for at-risk

children

Summary 2:

children. We present a multi-modular, machine learning-based assessment of autism comprising three

complementary modules for a unified outcome of diagnostic-grade reliability: A 4-minute, parent-report questionnaire delivered via a mobile app, a list of key behaviors identified from 2-minute, semi-structured home videos of children, and a 2-minute questionnaire presented to the clinician at the time of clinical assessment

Summary 3:

However, despite the increase of positive evidence,

this technology has rarely been applied to specific ASD

diagnosis.

This work aims to present a robot-assisted framework

using an artificial reasoning module to assist clinicians with

the ASD diagnostic process. The framework is composed of

a responsive robotic platform, a flexible and scalable vision

sensor network, and an automated face analysis algorithm

based on machine learning models. In this research we take

Summary 4:

We present a multi-modular, machine learning-based assessment of autism comprising three

Summary 5:

The ASD diagnosis is usually performed through several sessions of behavioral

observation, exhaustive screening, and manual coding behavior. The early detection of ASD signs in naturalistic behavioral

observation may be improved through Child-Robot Interaction (CRI) and technological-based tools for automated behavior

assessment

Summary 6:

Robot-assisted tools using CRI theories have been of interest in intervention for children with Autism Spectrum

Disorder (CwASD), elucidating faster and more significant gains from the diagnosis and therapeutic intervention when

Summary 7:

https://doi.org/10.1007/s10846-018-00975-y

Robot-AssistedAutismSpectrumDisorderDiagnosticBased

onArtificialReasoning

Andr´esA.Ram ´ırez-Duque1·AnselmoFrizera-Neto1·TeodianoFreireBastos1

Received:25April2018/Accepted:20December2018

Abstract

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that affects people from birth, whose symptoms are

found in the early developmental period

Summary 8:

Bekele, E., Lahiri, U., Swanson, A.R., Crittendon, J.A., Warren, Z.E., Nilanjan, S.: A step towards developing adaptive robot-mediated intervention architecture (ARIA) for children with autism. IEEE Trans. Neural Syst. Rehabil. Eng. 21(2), 289–299 (2013)

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Summary 9:

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32

Summary 10:

Nevertheless, different systems are able to modify the behavior of the robot according to environmental interactions and the child's response, using a closed-loop and artificial cognition approaches [12–16]. These systems have been hypothesized to offer technological mechanisms for supporting more flexible and potentially more naturalistic

interaction [17]. In fact, literature reports that automatic

robot's social behaviors modulation according to specifics

scenarios has a strong effect on child's social behavior

[12]

Query: What is Autism Spectrum Disorder, how it is caused?

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Summary 2:

1. ASD is diagnosed from clinical observations according to standard

criteria2 relating to the child's social and behavioral symptoms. Autism is said to be on a spectrum due to the

varied severities of symptoms, ranging from relatively mild social impairment to debilitating intellectual disabil-ities, inabilities to change routines and severe sensory reactions

2

Summary 3:

/gid00030/gid00035/gid00032/gid00030/gid00038/gid00001/gid00033/gid00042/gid00045 /gid00001

/gid00048/gid00043/gid00031/gid00028/gid00047/gid00032/gid00046

Abstract: Autism spectrum disorder (ASD) is a developmental disorder with a life-span disability. While diagnostic instruments have been developed and qualified based on the accuracy of the discrimination of children with ASD from typical development (TD) children, the stability of such procedures can be disrupted by limitations pertaining to time expenses and the subjectivity of clinicians

Summary 4:

3.Fakhoury M.Autistic spectrum disorders: Areview ofclinical features, theories anddiagnosis .IntJDev Neurosci. 2015; 43:70–7. https://doi.o rg/10.1016/j.ij devneu.2 015.04.003 PMID: 25862937

4.Constantino JN,Charma nT.Diagnosis ofautism spectrum disorder: reconciling thesyndrome, its diverse origins, andvariation inexpression .Lancet Neurol

Summary 5:

2016; 15(3):279– 91.https://do i.org/10.

1016/S1474- 4422(15)0 0151-9 PMID: 264977 71

5.Caldero niS,Billeci L,Narzisi A,Brambilla P,Retico A,Muratori F.Rehabilitat iveintervent ionsandbrain plasticity inautism spectrum disorde rs:focus onMRI-bas edstudies. Front Neurosci. 2016; 10:139. https://doi.or g/10.338 9/fnins.201 6.00139 PMID: 270657 95

6.Brentani H,Paula CSd, Bordini D,Rolim D,Sato F,Portolese J,etal.Autism spectrum disorders :an overview ondiagnos isandtreatment. Braz JPsychiatry. 2013; 35:S62 –S72

Summary 6:

At

present, research on autism is still in its infancy at home and abroad, and research methods and tools are still developing.

The main symptoms of autism include impaired social and interpersonal communication, language retardation, repetitive behavior and sensory dysfunction. It is difficult for autistic patients to correctly recognize faces and explain facial emotions. They have different

Summary 7:

basis of communication and interpersonal relationships with others. Abnormal expression is a prominent manifestation of autism, and it is also one of the criteria for the diagnosis of autism. Doctors can diagnose autism by responding to abnormal facial expressions in children.

Autism, also known as autism or autism disorders, is a representative disease of generalized developmental disorders. In recent years, the incidence of autism in children has become higher and higher, experiencing a transition from rare diseases to epidemics

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PLOS ONEEarly screening ofautism using cryfeatures

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assessment

Summary 11:

Approximately 25–50%3 of autistic children are

non-verbal and have severe symptoms.

Notably, diagnosis within the first few years of life dramatically improves the outlook of children with autism,

as it allows for treatment during a key window of developmental plasticity4,5. Unfortunately, the latest studies

show that although 85% of parents of children with autism reported developmental concerns about their chil-dren by 36 months of age, the median age of diagnosis in the United States is 52 months

1. The complexity of the

Summary 12:

Consequently, automated diagnostic methods have been developed for acquiring objective

measures of autism, and in various fields of research, vocal characteristics have not only been reported

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Query: What are Stereotypical and maladaptive behaviors in Autism Spectrum, how are these detected and managed?

Summary 1:

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Summary 2:

Children

with ASD are known to have abnormalities in their prosody resulting from deficits in their ability to

recognize the inherent mental conditions of others [9], and their atypical vocalizations are known to be

monotonous or exaggerated, which can be revealed using various acoustic characteristics, followed

by engineering approaches for the discrimination of ASD or typical development (TD) in children

based on the vocal and acoustic features

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https://doi.org/10.1007/s10846-018-00975-y

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Summary 4:

Sensors 2020 ,20, 6762 2 of 11

social abilities of people with ASD increases when an earlier clinical intervention is performed [4], the

early detection of ASD characteristics has become a key point of current ASD research.

Various instruments for discriminating ASD have been developed, and the commonly accepted gold standard schemes are behavioral assessments, which are time-consuming procedures and require multidisciplinary teams (MDTs)

Summary 5:

However, most behavioral assessments su ffer in terms of the stability of their ASD diagnosis as a result of the issues of accessibility or subjectivity and interpretive bias between professions [5]. Therefore, several attempts to develop objective and precise diagnostic methods have been made in multiple fields, such as genetic determination [6], principle analysis of brain images [7], and physiological approaches [8].

One prominent area of behavioral observations is that of infants' vocal characteristics. Children

Summary 6:

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Summary 11:

For example, in [10], the researchers estimated deficits in the

vocalization of children with ASD at an average age of 18 months, such as “flat” intonation, atypical pitch, or control of volume based on the variability of pitch and the long-term average spectrum (LTAS) using fast Fourier transform, where significant di fferences were observed in the spectral

Query: How relevant is eye contact and how it can be used to detect Autism?

Summary 1:

Machine learning methods were use d to establish models for

early screening of ASD.

Results: During the face-to-face interaction (FF) episode of the SFP , there were

statistically significant differences in the duration and f requency of eye contact, social

smiling,andactivesocialengagementbetweenthetwogroup s.Duringthestill-face(SF)

episode, there were statistically significant differences in the duration and frequency of

eye contact and active social engagement between the two gro ups. The 45 children in

Summary 2:

25. Chong, E., Chanda, K., Ye, Z., Southerland, A., Ruiz, N., Jones,

R.M., Rozga, A., Rehg, J.M.: Detecting gaze towards eyes in

natural social interactions and its use in child assessment. Proc.

ACM Interact. Mob. Wearable Ubiquitous Technol. 1(3), 43:1–

43:20 (2017)

26

Summary 3:

sion and its integration with eye gaze (e.g., during socialreferencing) have been found to differentiate children

with ASD from typically developing children, as well

as those who have other developmental delays, asearly as 12 months of age [Adrien et al., 1991;

S. Clifford et al., 2007; Filliter et al., 2015; Gangi,

Ibanez, & Messinger, 2014; Nich ols, Ibanez, Foss-Feig, &

Stone, 2014]

Summary 4:

screeningforASDwithmoreobjectivemethod,behavioralvi deoswereusedinanumber

of studies in recent years.

Method: The still-face paradigm (SFP) was adopted to measure the fre quency and duration of non-social smiling, protest behavior, eye cont act, social smiling, and active social engagement in high-risk ASD group (HR) and typical de velopment group (TD) (HR:n=45; TD:n=43). The HR group was follow-up until they were 2 years old to confirm final diagnosis

Summary 5:

areas, so as to promote the early diagnosis and treatment of autistic children and reduce the medical costs and burdens of autistic families and society. Therefore, this study has more important social significance and application value.

References

Baron-Cohen, S., Wheelwright, S., Jolliffe, T. (1997), “Is there a “language of the eyes ”? Evidence from normal adults, and adults with autism or asperger syndrome ”,Visual Cognition , Vol. 4 No. 3, pp

Summary 6:

Ness, S.L., Manyakov, N.V ., Bangerter, A., Lewin, D., Jagannatha, S., Boice, M., Skalkin, A., Dawson, G., Janvier, Y .M., Goodwin, M.S., Hendren, R., Leventhal, B., Shic, F., Cioccia, W., Gahan, P.: JAKE® Multimodal data capture system: Insights from an observational study of autism spectrum disorder. Frontiers in Neuroscience 11(SEP) (2017)

Summary 7:

As such, differences in facial affect may show utility in assessing early risk for ASD. A recent meta-analysis of facial expression production in autism found that individuals with ASD display facial

expressions less often than non-ASD participants andthat, when they did display facial expressions, the expres-

sions occurred for shorter durations and were of different

Summary 8:

311-331.

Beijing Wucai Deer Autism Research Institute (2017), Report on the Development of Autism Education

and Rehabilitation Industry in China 2 , Huaxia Publishing House, Beijing.Facial

expressions for

autism

diagnosis

Summary 9:

Rehg, J.M., Abowd, G.D., Rozga, A., Romero, M., Clements,

M.A., Sclaroff, S., Essa, I., Ousley, O.Y ., Li, Y ., Kim, C., Rao,

H., Kim, J.C., Lo Presti, L., Zhang, J., Lantsman, D., Bidwell,

J., Ye, Z.: Decoding children's social behavior. In: 2013 IEEE

Conference on Computer Vision and Pattern Recognition, pp.

3414–3421 (2013)

Query: How can cross country trials help in development of Machine learning based Multimodal solutions?

Summary 1:

We havealso shown some important pitfalls when applying machine learningin this domain, and quantified the benefit of applying proper solu-

tions to address them.

FUNDING

This research received no specific grant from any funding agency in the pub-

lic, commercial or not-for-profit sectors.

COMPETING INTERESTS

All authors are affiliated with Cognoa Inc. in an employment and/or

advisory capacity.

CONTRIBUTORS

All listed authors contributed to the study design as well as the draft-ing and revisions of the paper

Summary 2:

including screening for cognitive conditions such as dementia for the

elderly and physical conditions such as concussions in adults. Fur-ther, we expect that these methods would apply well to any othersurvey based domain in which the application context is differentfrom the training context.

Significant further improvements may be possible. Initial studies

have identified probable improvements to the machine learningmethodology as well as improved methods for handling the biasesbetween the training data and application settings

Summary 3:

CONCLUSION

Machine learning can play a very important role in improving the ef-fectiveness of behavioral health screeners. We have achieved a sig-nificant improvement over established screening tools for autism inchildren as demonstrated in a multi-center clinical trial

Query: How early infants cry can help in the early detection of Autism?

Summary 1:

[34] proposed another vocalization-based classification method inwhich they included age

and excluded crying. They applied themethod on106TDchildren and 77children with ASD

between 16to48months and reached 86% accuracy. Pokorny etal.[35] extracted eGeMAPS

parameter set[37], which includes 88acoustic parameters, in10month oldchildren. This set

consists ofstatistics calculated for25frequency-related, energy-related, and spectral low-level

descriptors

Summary 2:

knowledge, ourown group's preliminary study [41] wastheonly research that hasused cry sounds forthescreening ofchildren with ASD. Weused adataset of5children with ASD and 4TDchildren older than twoyears. The accuracy oftheproposed method is96.17% using k-fold cross validation without considering subject-wise hold out, which isashortcoming ofthis study. Inother words, ithasbeen overfitted totheavailable data and may failtocorrectly clas-sifynew samples

Summary 3:

The result ofstudying these 57children under theageof18months may suggest that: a) there could besymptoms inthecrying sounds ofchildren with neurodevelopmental disorders under 18months (Child1 and Child2), b)theapproach may notbeable toscreen aparticipant with neurodevelopmental disorders under theageof18months duetothepossibility that: 1) theparticipant wasamong those children with neurodevelopmental disorders who donot have ourproposed specific features intheir crying sounds, 2)theparticipant's recorded cry samples didnotinclude ourspecific features, and/or 3)neurodevelopmental disorders and their features hadnotbeen developed inthechild atthetime ofinitial recording

Summary 4:

b.2orb.3.Toclearly determine anyreason behind thisphenomena, afurther investigation is needed.

Webelieve that thisapproach canbeused toperform early autism screening under 18 months ofage

Summary 5:

Thus, inthefuture, weneed tocollect data and testtheapproach onmore data ofchildren under 18months tovalidate these results with more confidence.

Wehave tofurther check theproposed approach and theextracted features onother neuro-

developmental disorders, such asADHD, toevaluate thecapability oftheapproach todistinguish thechildren with these disorders from TDchildren.
Furthermore, without comparing thecrysounds ofchildren with ASD tothose without ASD butanother disorder, wedonotreally know ifthese findings arespecific toautism orto general atypical brain developments

Summary 6:
The reason
behind notclassifying Child3 and Child4, aschildren with ASD under theageof18,could be b.2orb.3.Toclearly determine anyreason behind thisphenomena, afurther investigation is needed.
Webelieve that thisapproach canbeused toperform early autism screening under 18

Summary 7:
1093/gigas cience/gix02 0PMID: 283279 89
37. Eyben F,Scherer KR,Schulle rBW,Sundberg J,Andre ´E,Busso C,etal.TheGeneva minimalis tic acoustic parame terset(GeMAPS)forvoice research andaffective comput ing.IEEE Trans Affect Comput.2015; 7(2):190–2 02.
38. Esposito G,Hiroi N,Scattoni ML.Cry,Baby, Cry:Expressio nofDistres sAsaBiomarke randModulato r inAutism Spectrum Disorder. IntJNeuropsyc hopharmac ol.2017; 20(6):498– 503. https:// doi.org/10.1093/ijnp/py x014 PMID: 28204487
39

Summary 8:
Thus, weshould collect crysounds ofchildren with other
neurodevelopmental disorders and compare voices ofchildren with ASD tovoices ofchildren with other neurodevelopmental disorders toseeifthese features would beable toseparate

Summary 9:

Sheinkopf SJ,Iverson JM,Rinaldi ML,Lester BM.Atypical CryAcoustics in6-Month-Ol dInfants atRisk forAutism Spectrum Disorder. Autism Res. 2012; 5(5):331–9 .https://doi.or g/10.100 2/aur.1244 PMID: 22890558

40. Orlandi S,Manfredi C,Bocchi L,Scattoni ML,editors. Automatic newborn cryanalysis: anon-invas ive tooltohelpautism early diagno sis.In:Proceedings oftheAnnual International Conferen ceoftheIEEE Engineeri nginMedicine andBiology Society; 2012; SanDiego, CA,USA: IEEE. 2012. Doi:10.1109 /

Summary 10:

So,athorough examination using anunseen testsetoncryfeatures isneces-
sary toevaluate theresults. Itshould benoted that thedata from ourprevious study [41] could notbeused inthestudy presented inthispaper duetothedifferences indata collection procedures.

Inalltheabove studies, itwasassumed that thespecific sound features, distinguishing chil-
dren with ASD from TDchildren, arecommon among alltheASD cases. However, thismay notbethecase forallthefeatures. Forinstance, tiptoe walking, which isoneoftherepetitive

Query: What are various methods to detect Atypical Pattern of Facial expression in Children?

Summary 1:

RESEARCH ARTICLE

Digital Behavioral Phenotyping Detects Atypical Pattern of Facial
Expression in Toddlers with Autism

Kimberly L. H. Carpenter , Jordan Hahemi, Kathleen Campbell, Steven J. Lippmann, Jeffrey P. Baker, Helen L

Summary 2:

of risk behavior, namely, patterns of facial expression, in 104 toddlers (ASD N= 22) and evaluated whether such patterns

differentiated toddlers with and without ASD. The assessment consisted of the child sitting on his/her caregiver ’s lap and

watching brief movies shown on a smart tablet while the embedded camera recorded the child ’s facial expressions. Com-

puter vision analysis (CVA) automatically detected and tracked facial landmarks, which were used to estimate head posi-tion and facial expressions (Positive, Neutral, All Other)

Summary 3:

Using CVA, speci fic points throughout the movies were

identi fied that reliably differentiate between children with and without ASD based on their patterns of facial movement

and expressions (area under the curves for individual movies ranging from 0.62 to 0.73). During these instances, children

with ASD more frequently displayed Neutral expressions compared to children without ASD, who had more All Other

Summary 4:

with ASD more frequently displayed Neutral expressions compared to children without ASD, who had more All Other

expressions. The frequency of All Other expressions was driven by non-ASD children more often displaying raised eye-brows and an open mouth, characteristic of engagement/interest. Preliminary results suggest computational coding of

facial movements and expressions via a tablet-based assessment can detect differences in affective expression, one of the

early, core features of ASD

Summary 5:

This study assessed the utility of a tablet-based behavioral assessment for eliciting and detecting one type

of risk behavior, namely, patterns of facial expression, in 104 toddlers (ASD N= 22) and evaluated whether such patterns

Summary 6:

Autism Res 2020, 00: 1 –12.

Lay Summary: This study tested the use of a tablet in the behavioral assessment of young children with autism. Children

watched a series of developmentally appropriate movies and their facial expressions were recorded using the camera

embedded in the tablet. Results suggest that computational assessments of facial expressions may be useful in early detec-

tion of symptoms of autism.

Summary 7:

recognition obstacles, which are mainly manifested in their inability to recognize facial

expressions (Liuet al., 2015). It is easy to distinguish autistic children from normal children by

observing their facial expressions. Therefore, we combine facial expression recognition

technology to extract facial expression response feature vectors and use artificial intelligence

technology to distinguish normal group and autistic group based on these facial features.

3.2.2 The principle of diagnosing autism through facial expressions

Summary 8:

facial expression, which was more common in the ASDgroup. Through this analysis, we identi fied the features of

raised eyebrows and open mouth to play a role in dis-

criminating between the Other vs. Neutral categories.This facial pattern is consistent with an engaged/inter-

ested look displayed when a child is actively watching, as

described in young children by Sullivan and Lewis [2003].It is interesting to note a raised pitch angle was also statis-

tically signi ficant

Summary 9:

Since the median difference of this

angle between the two facial expression is small (3.2

/C14),

this may be a natural movement of raising one ’s

eyebrows.

Our results need to be considered in light of several

limitations. First, the CVA models of facial expressions

used in the current study were trained on adult faces

[Hashemi et al., 2018]. Despite this, our previous findings

with young children demonstrate good concordance

between human and CVA coding on the designation of

Summary 10:

Egger, Steven Espinosa, Saritha Vermeer, Guillermo Sapiro, and Geraldine Dawson

Commonly used screening tools for autism spectrum disorder (ASD) generally rely on subjective caregiver questionnaires.

While behavioral observation is more objective, it is also expensive, time-consuming, and requires signi ficant expertise to

perform. As such, there remains a critical need to develop feasible, scalable, and reliable tools that can characterize ASD

risk behaviors

Summary 11:

A large number of

studies have pointed out that autistic patients have deficiencies in facial expression

recognition and understanding. This is the core source of impaired social function in

autistic patients (Yang et al. , 2017). Autistic children are more difficult to identify other

people ’s emotional behavior, and it is difficult to make appropriate judgment and responseLHT

Query: What kind of facial expressions can be used to detect Autism Disorder in children?

Summary 1:

with ASD more frequently displayed Neutral expressions compared to children without ASD, who had more All Other

expressions. The frequency of All Other expressions was driven by non-ASD children more often displaying raised eye-brows and an open mouth, characteristic of engagement/interest. Preliminary results suggest computational coding of

facial movements and expressions via a tablet-based assessment can detect differences in affective expression, one of the

early, core features of ASD

Summary 2:

With the

progress of artificial intelligence technology, facial expression recognition technology can

objectively and effectively reflect the mental health of children and can be used in early

diagnosis of autism (Yanbin et al., 2018).

We also communicated with doctors of Hubei Maternal and Child Health Hospital, Wuhan

Children ’s Hospital and Guangzhou Women and Children ’s Medical Center many times, and

actually checked the process of using the above autism diagnostic scale to diagnose children.

Summary 3:

Autism Res 2020, 00: 1 –12.© 2020 International Society for Autism Research and Wiley

Periodicals LLC

Lay Summary: This study tested the use of a tablet in the behavioral assessment of young children with autism. Children

watched a series of developmentally appropriate movies and their facial expressions were recorded using the camera

embedded in the tablet. Results suggest that computational assessments of facial expressions may be useful in early detec-

tion of symptoms of autism.

Summary 4:

As such, fre-
quency and duration of facial affect is a promising early
risk marker for young children with autism.
Previous research on atypical facial expressions in chil-
dren with ASD has relied on hand coding of facial expres-
sions, which is time intensive and often requiressignificant training [Bieberich & Morgan, 2004; S. Clifford et al., 2007; Dawson et al., 1990; Gangi et al., 2014;
Mcgee et al., 1991; Nichols et al., 2014; Snowet al., 1987]

Summary 5:

recognition obstacles, which are mainly manifested in their inability to recognize facial expressions (Liuet al., 2015). It is easy to distinguish autistic children from normal children by observing their facial expressions. Therefore, we combine facial expression recognition technology to extract facial expression response feature vectors and use artificial intelligence technology to distinguish normal group and autistic group based on these facial features.

3.2.2 The principle of diagnosing autism through facial expressions

Summary 6:

A large number of
studies have pointed out that autistic patients have deficiencies in facial expression recognition and understanding. This is the core source of impaired social function in autistic patients (Yang et al. , 2017). Autistic children are more difficult to identify other people ’s emotional behavior, and it is difficult to make appropriate judgment and responseLHT

Summary 7:

thermore, higher frequency of neutral expressions corre-lates with social impairment in children with ASD
[Owada et al., 2018] and differentiates them from chil-
dren with other delays [Bieberich & Morgan, 2004;Yirmiya, Kasari, Sigman, & Mundy, 1989]

Summary 8:

It was found that autistic adults had better recognition of some basic facial expressions, such as happiness, but relatively complex facial expressions such as surprise recognition were difficult to recognize.

At present, the main diagnostic criteria of autism are: IDC-10, DSM-IV, the autism child behavior scale (ABC), the children autism rating scale (CARS) and the Clancy behavior scale (CABS) (Wang, 2007).

After consulting a large number of literatures and investigating the actual situation of the

Summary 9:

This approach is not scalable for use in gen-

eral ASD risk screening or as a behavioral biomarker or

outcome assessment for use in large clinical trials. Assuch, the field has moved toward automating the coding

of facial expressions. In one of the earliest studies of this

Summary 10:

facial expressions, and the twenty-fourth item was active avoidance of eye contact with others. Fifteen items of the CARS scale, the third of which is emotional response, pleasure and unhappiness and interest, are expressed by changes in facial expression and posture. These scales basically include the items of autism detection by children ’s facial expressions, which show that the diagnosis of autism can be more accurate by facial expressions

Summary 11:

(Shen et al. , 2013). Overseas research on facial expression recognition ability of autistic patients has been carried out not only in children but also in adults. Most studies believe that the ability of facial expression recognition of autistic patients is low. Baron-Cohen et al. (1997) used standard facial expression maps to study the recognition of different emotional types in

autistic adults

Query: What are methods to detect Autism from home videos?

Summary 1:

Allwere given instructions onhow totagthe30questions and were asked

toscore 10example videos before performing independent feature tagging ofnew videos.

Table 1.Eight machine learning classifier sused forvideo analysis and autism detection .The models were constructe dfrom ananalysis ofarchived medical records

from theuseofstandard instruments, including theADOS and theADI-R. All8models identified asmall, stable subset offeatures incross-validat ionexperime nts.The

Summary 2:

Features needed bymachine learning models designed todetect autism

canbeidentified and measured inhome videos onmobile devices bynonexperts in

timeframes close tothetotal video length and under 6minutes.

•The machine learning models provide aquantitative indication ofautism risk that pro-

vides more granularity than abinary outcome toflaginconclusive cases, potentially add-

ingvalue foruseinclinical settings, e.g., fortriage.

•The process ofmobile video analysis forautism detection generates agrowing matrix of

video features that canbeused toconstruct new machine learning models that may

have higher accuracy forautism detection inhome video.

•Clinical prospective testing ingeneral pediatric settings onpopulations notyetdiag-

Summary 3:

Wethen collected 116short home videos ofchildren with

autism (mean age=4years 10months, SD=2years 3months) and46videos oftypically

Summary 4:

Tovalidate self-reporting ofthepresence orabsence ofanASD diagnosis, 2 clinical staff trained and certified inautism diagnosis evaluated arandom selection of30videos (15with ASD and 15non-ASD) from the162videos. Their classifications hadperfect correspondence with thediagnoses provided through self-report bytheprimary caregiver. Werandomly selected 50videos (25ASD and 25non-ASD) from thetotal 162collected videos and had9raters feature tagallinaneffort toevaluate thepotential foranoptimal num-

Summary 5:

What dothese findings mean?

•Short home videos canprovide sufficient information torunmachine learning classifierstrained todetect children with autism from those with either typical oratypical development

Summary 6:

thattheuseofmachine learning analysis onhome video canspeed thediagnosis without compromising accuracy. Wehave analyzed item-level records from 2standard diagnostic instruments toconstruct machine learning classifiers optimized forsparsity, interpretability, andaccuracy

Query: What is Still-Face Paradigm in Early Screening for High-Risk Autism Spectrum Disorder?

Summary 1:

andToddlers.Front.Pediatr.8:290.

doi:10.3389/fped.2020.00290Application of the Still-Face Paradigm in Early Screening for High-Risk Autism Spectrum Disorder in Infants and Toddlers

NanaQiu1,ChuangaoTang2,MengyaoZhai1,WanqingHuang3,JiaoWeng1,ChunyanLi1, XiangXiao1,JunliFu1,LiliZhang4,TingXiao1,HuiFang1andXiaoyanKe1*

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UniversityofPostsandTelecommunications,Nanjing,Chin a,4WuxiChildren'sHospital,Wuxi,China

Background: Although autism spectrum disorder (ASD) can currently be di agnosed at

the age of 2 years, age at ASD diagnosis is still 40 months or ev en later

Summary 2:

screeningforASDwithmoreobjectivemethod,behavioralvi deoswereusedinanumber

of studies in recent years.

Method: The still-face paradigm (SFP) was adopted to measure the fre quency and

duration of non-social smiling, protest behavior, eye cont act, social smiling, and active

social engagement in high-risk ASD group (HR) and typical de velopment group (TD)

(HR:n=45; TD:n=43). The HR group was follow-up until they were 2 years old

to confirm final diagnosis

Summary 3:

In order to early

screeningforASDwithmoreobjectivemethod,behavioralvi deoswereusedinanumber

of studies in recent years.

Method: The still-face paradigm (SFP) was adopted to measure the fre quency and

Summary 4:

Though facial affect is the focus of the cur-

rent analysis, the ultimate goal is to combine informationacross autism risk features collected through the current

digital screening tool [e.g., delayed response to name as

described in Campbell et al., 2019], to develop a risk scorebased on multiple behaviors [Dawson & Sapiro, 2019].

This information could then be combined with addi-
tional measures of risk to enhance screening for ASD.
Methods
Participants

Summary 5:
Machine learning methods were use d to establish models for
early screening of ASD.
Results: During the face-to-face interaction (FF) episode of the SFP , there were
statistically significant differences in the duration and f requency of eye contact, social
smiling,andactivesocialengagementbetweenthetwogroup s.Duringthestill-face(SF)
episode, there were statistically significant differences in the duration and frequency of
eye contact and active social engagement between the two gro ups. The 45 children in

Summary 6:
Qiu et al. Early Screening for High-Risk ASD
with autism spectrum disorders: an examination of the broad phenot ype.J
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parenting style on social smiling in infants at high and low risk for A SD.J
AutismDevDisord

Summary 7:
As such, fre-
quency and duration of facial affect is a promising early
risk marker for young children with autism.

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eral ASD risk screening or as a behavioral biomarker or

outcome assessment for use in large clinical trials. Assuch, the field has moved toward automating the coding

of facial expressions. In one of the earliest studies of this

Summary 9:

these movies in a fully automated system on a cost-

effective tablet whereby the elicited behaviors, in thiscase the frequency of different patterns of facial affect,

are automatically encoded with CVA, we aim to create a

tool that is objective, ef ficient, and accessible. The cur-

rent analysis focuses on preliminary results supporting

the utility of this tablet-based assessment for the detec-

tion of facial movement and affect in young children andthe use of facial affect to differentiate children with and

without ASD

Summary 10:

(2016)46:2399–407.doi:10.1007/s10803-016-2772-y

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between contradictory messages in face-to-face interaction. J Am Acad Child

Psychiatry. (1978)17:1–13.doi:10.1016/S0002-7138(09)62273-1

14. MantisI,StackDM,NgL,SerbinLA,SchwartzmanAE.Mutualt ouchduring

mother–infant face-to-face still-face interactions: influenc es of interaction

Query: What is West Syndrome?

Summary 1:

To date, few seminal studies have

attempted to apply social signal processing to

mother –infant interactions with or without a speci fic

condition, and these studies have focused on speech turns(e.g., Jaffe et al.

10), motherese11, head movements12, hand

movements13, movement kinematics2, and facial

expressions3.

Here, we focused on West syndrome (WS), a rare epi-

leptic encephalopathy with early onset (before age 1 year)

and a high risk of NDD outcomes, including one-third of

WS children showing later autism spectrum disorder(ASD) and/or intellectual disability (ID)

Summary 2:

Translational Psychiatry (2020) 10:54

https://doi.org/10.1038/s41398-020-0743-8 Translational Psychiatry

ARTICLE Open Access

Behavior and interaction imaging at 9 months of

age predict autism/intellectual disability in high-riskinfants with West syndrome

Lisa Ouss1,G i u s e p p eP a l e s t r a2, Catherine Saint-Georges2,3, Marluce Leitgel Gille1, Mohamed Afshar4,

Hugues Pellerin2, Kevin Bailly2, Mohamed Chetouani2, Laurence Robel1,B e r n a r dG o l s e1, Rima Nabbout5,

Isabelle Desguerre5, Mariana Guergova-Kuras4and David Cohen2,3

Abstract

Automated behavior analysis are promising tools to overcome current assessment limitations in psychiatry

Summary 3:

At

9 months of age, we recorded 32 infants with West syndrome (WS) and 19 typically developing (TD) controls during astandardized mother –infant interaction. We computed infant hand movements (HM), speech turn taking of both

Query: What is the utility of Behavior and interaction imaging at 9 months of age predict autism/intellectual disability in high-risk infants with West syndrome?

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Abstract

Automated behavior analysis are promising tools to overcome current assessment limitations in psychiatry

Summary 2:

In the context of

WS, we showed that such a method we proposed to label‘behavioral and interaction imaging ’was able to sig-

nificantly predict the development of ASD or ID at 4 years

of age in high-risk children who had WS and were

assessed at 9 months of age.

Acknowledgements

The authors thank all of the patients and families who participated in thisstudy. The study was funded by the EADS foundation (PILE), by the Agence

Nationale de la Recherche (ANR-12-SAMA-006-1) and the Groupement de

Recherche en Psychiatrie (GDR-3557)

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At

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Here, we focused on West syndrome (WS), a rare epi-

leptic encephalopathy with early onset (before age 1 year)

and a high risk of NDD outcomes, including one-third of

WS children showing later autism spectrum disorder(ASD) and/or intellectual disability (ID)

Summary 5:

play and perturbed mother-infant interaction. IEEE Trans. Affect Comput. 6,

361–370 (2015).

13. Ouss, L. et al. Developmental trajectories of hand movements in typical infants

and those at risk of developmental disorders: an observational study ofkinematics during the fi

rst year of life. Front Psychol. 9,8 3(2 0 1 8) .

14. Ouss, L. et al. Taking into account infant ’s engagement and emotion during

early interactions may help to determine the risk of autism or intellectual

disability in infants with West syndrome. Eur. Child Adolesc

Summary 6:

partners (vocalization, pause, silences, overlap) and motherese. Then, we assessed whether multimodal social signals

and interactional synchrony at 9 months could predict outcomes (autism spectrum disorder (ASD) and intellectualdisability (ID)) of infants with WS at 4 years. At follow-up, 10 infants developed ASD/ID (WS +). The best machine

learning reached 76.47% accuracy classifying WS vs. TD and 81.25% accuracy classifying WS +vs. WS−

Summary 7:

interposing between the camera and the infant); the final

sample size of WS +(N=10) that limited the power of

machine learning methods.

We conclude that the method proposed here combining

multimodal automatized assessment of social signal pro-cessing during early interaction with infants at risk forNDD is a promising tool to decipher clinical features thatremain dif ficult to identify and assess