Title:

Group 7

Members

1. **Introduction**

It is a known fact that stress whether it be physical, emotional, mental, financial, spiritual and what have you has always been endemic to the human species. And while stress can have its negative connotation it is not however all that bad, and in fact is an evolutionary mechanism that has aided in the survival of our species for millions of years from perhaps predators that preyed upon us, and moreover that stress some would argue it can only ever be “bad” when it comes too much or pathological.

In the field of psychophysiology Electrodermal Activity (EDA) is a low-cost and non-intrusive way of monitoring the emotional state of a subject, and a viable gateway to study the Sympathetic Nervous System (SNS), which is responsible for the so-called ﬁght-or-ﬂight responses happening at the unconsciousness level [1]. The sympathetic nervous system moreover is the system that prepares the body to react to a stressful situation and that predominates when there are both positive and negative forms of stress present in moments of the life of an individual.

EDA is also a frequently used modality in psychophysiology, because of its ability to obtain a distinct Electrodermal Response (EDR) in response to a stimulus. The possible uses of EDA are well documented; the most important examples include research on epilepsy, autism, stress and anxiety [2].

**Benefit of interpreting electrodermal activity (cite papers that highlight the importance and use of electrodermal activity data)**

On the other side of the picture 20% of the 30.000 people in the Netherlands for instance with an intellectual disability (ID) who live in a residential setting show “severe behavioural problems” as well as self-injurious behaviour (SIB). Categorised as challenging behaviours (CB), such behaviours are a serious problem in the daily care of people with a mental disability, particularly to caretakers, since they try to anticipate CB by relying on their experience on what mix of visual and/ or verbal cues from the client (in a particular context) might be indicative of upcoming aggression. Upcoming aggression might be found in changes in their physiology such as heart rate (variability) as well as electrodermal activity (EDA). Changes in these markers are not readily perceived by caretakers.

Interestingly, these physiological changes are relatively easy to measureBecause of these developments it is now seems feasible to continuously measure changes

in the physiology of clients in (almost) any situation

Noordzij, Matthijs & Scholten, Patrick & Laroy-Noordzij, Marleen. (2012). Measuring electrodermal activity of both individuals with severe mental disabilities and their caretakers during episodes of challenging behavior.

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Despite its popularity, little research has been done into detecting noise and artifacts in an EDA signal. This is especially problematic given the increasing number of studies that are collecting ambulatory EDA data over long time periods using wearable devices (e.g. [ 2 ] [ 5 ] [ 7 ] [ 11 ] [ 14 ]).

Doberenz S, et al. Methodological considerations in ambulatory skin conductance monitoring. *Int J of Psychophysiology.* 2011;80(2):87–95. [[PMC free article](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3075336/)] [[PubMed](https://pubmed.ncbi.nlm.nih.gov/21320551)] [[Google Scholar](https://scholar.google.com/scholar_lookup?journal=Int+J+of+Psychophysiology&title=Methodological+considerations+in+ambulatory+skin+conductance+monitoring&author=S+Doberenz&volume=80&issue=2&publication_year=2011&pages=87-95&)]

Hedman EB. *PhD thesis.* MIT; 2010. In-situ measurement of Electrodermal Activity during Occupational Therapy. [[Google Scholar](https://scholar.google.com/scholar_lookup?title=PhD+thesis&author=EB+Hedman&publication_year=2010&)] [[Ref list](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5413200/#R5)]

Kappeler-Setz C, et al. Towards long term monitoring of electrodermal activity in daily life. *Pers ubiquit comput.* 2013;17(2):261–271. [[Google Scholar](https://scholar.google.com/scholar_lookup?journal=Pers+ubiquit+comput&title=Towards+long+term+monitoring+of+electrodermal+activity+in+daily+life&author=C+Kappeler-Setz&volume=17&issue=2&publication_year=2013&pages=261-271&)] [[Ref list](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5413200/#R7)]

Sano A, et al. Discriminating high vs low academic performance, self-reported sleep quality, stress level, and mental health using personality traits, wearable sensors and mobile phones. *Body Sensor Networks (BSN)* (to appear) 2015. [[PMC free article](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5431072/)] [[PubMed](https://pubmed.ncbi.nlm.nih.gov/28516162)] [[Google Scholar](https://scholar.google.com/scholar_lookup?journal=Body+Sensor+Networks+(BSN)&title=Discriminating+high+vs+low+academic+performance,+self-reported+sleep+quality,+stress+level,+and+mental+health+using+personality+traits,+wearable+sensors+and+mobile+phones&author=A+Sano&)] [[Ref list](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5413200/#R11)]

Wilhelm FH, Roth WT. Taking the laboratory to the skies: Ambulatory assessment of self-report, autonomic, and respiratory responses in flying phobia. *Psychophysiology.* 1998;35(5):596–606. [[PubMed](https://pubmed.ncbi.nlm.nih.gov/9715103)] [[Google Scholar](https://scholar.google.com/scholar_lookup?journal=Psychophysiology&title=Taking+the+laboratory+to+the+skies:+Ambulatory+assessment+of+self-report,+autonomic,+and+respiratory+responses+in+flying+phobia&author=FH+Wilhelm&author=WT+Roth&volume=35&issue=5&publication_year=1998&pages=596-606&pmid=9715103&)] [[Ref list](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5413200/#R14)]

While these studies may provide profound insight into how affect and stress interact with other factors in daily life, continuous and unobtrusive measurement of EDA using wearable devices makes the signal collected vulnerable to several types of noise. Artifacts can be generated from electronic noise or variation in the contact between the skin and the recording electrode caused by pressure, excessive movement, or adjustment of the device. If these artifacts remain in the signal when it is analyzed they can easily be misinterpreted and skew the analysis; for example, they may be mistaken for a skin conductance response (SCR) (a physiological reaction that may indicate increased stress).

Taylor S, Jaques N, Chen W, Fedor S, Sano A, Picard R. Automatic identification of artifacts in electrodermal activity data. Annu Int Conf IEEE Eng Med Biol Soc. 2015;2015:1934-7. doi: 10.1109/EMBC.2015.7318762. PMID: 26736662; PMCID: PMC5413200.

Consequently, many researchers are forced to manually inspect the data in order to decide which portions are too noisy to retain (e.g. [ 3 ]).

Fedor S, Picard R. Ambulatory eda: Comparisons of bilateral forearm and calf locations. 2014;51:S76–S76. [[Google Scholar](https://scholar.google.com/scholar?q=Fedor+S+Picard+R+Ambulatory+eda:+Comparisons+of+bilateral+forearm+and+calf+locations+51+S76+S76+2014+)] [[Ref list](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5413200/#R3)]

This approach cannot scale to the type of large-scale EDA studies that are currently being proposed [ 7 ]

Kappeler-Setz C, et al. Towards long term monitoring of electrodermal activity in daily life. *Pers ubiquit comput.* 2013;17(2):261–271. [[Google Scholar](https://scholar.google.com/scholar_lookup?journal=Pers+ubiquit+comput&title=Towards+long+term+monitoring+of+electrodermal+activity+in+daily+life&author=C+Kappeler-Setz&volume=17&issue=2&publication_year=2013&pages=261-271&)] [[Ref list](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5413200/#R7)]

, which may involve data collected from hundreds of participants over weeks or months.

**Importance of the task of identifying artefacts (cite papers that highlight the importance and use of the task of identifying artefacts in electrodermal activity data, what are artefacts, and what key role artefacts play)**

**Existing state of the art methods in automatically identifying artefacts in eda data (cite papers on the current ways of detecting artefacts)**

In this study researchers propose the use of deep learning based methods in better detection of artefacts in electrodermal activity datasets

1. **Aim of the Study**
2. **Objectives**
3. **Methodology**
4. **Significance of the Study**
5. **References:**
6. W. Boucsein, Electrodermal activity, 2nd ed. Springer US, 2012.
7. Banganho, António & Santos, Marcelino & Plácido da Silva, Hugo. (2022). Electrodermal Activity: Fundamental Principles, Measurement and Application. IEEE Potentials. 41. 35-43. 10.1109/MPOT.2020.2983381.