Connectivity analysis during the first year of life

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OUTLINE

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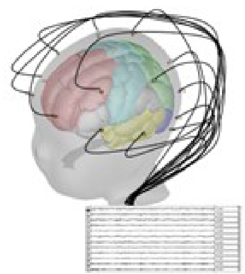
- Conclusion

INTRODUCTION

- The World Health Organization estimates the prevalence of preterm birth to be 5–18% across 184 countries worldwide.
- Preterm birth is a leading risk factor for delayed mental and/or psychomotor development, executive dysfunction, neurosensory disability, attention deficit hyperactivity disorder, and others.
- We present a longitudinal study of EEG connectivity during the first year of life in infants using PLI measure at source level.

METHODS

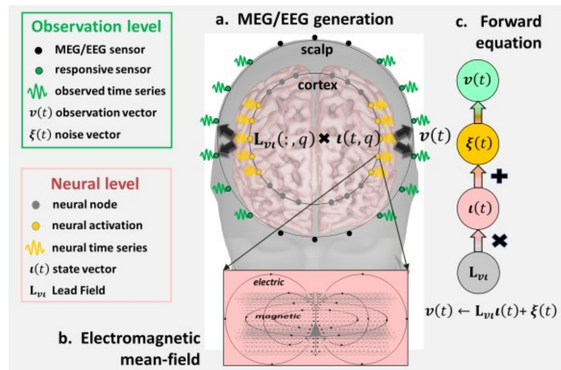
A – rsEEG scalp level



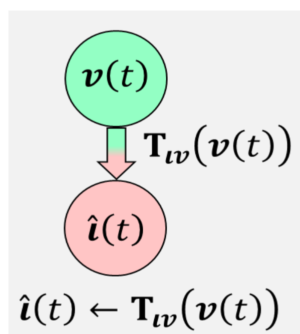
AG	N	Sex (F)	EEGs	GA
FT	71	29	82	38-41
LP	54	25	112	32-37
VP	56	27	103	27-31

Ethical permission was granted by the Ethics Committee of the Instituto de Neurobiología of the Universidad Nacional Autónoma de México.

B – rsEEG source level



Solution of the inverse problem to estimate EEG cortical sources based on sSSBL+:



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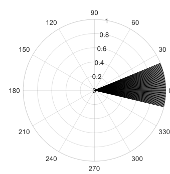
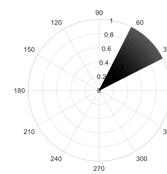
C – Phase based connectivity

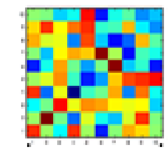
$$PLI = \left| n^{-1} \sum_{t=1}^{n} sgn\left(Im\left[e^{i(\varphi^j - \varphi^k)t} \right] \right) \right|$$

PLI = 0.23333



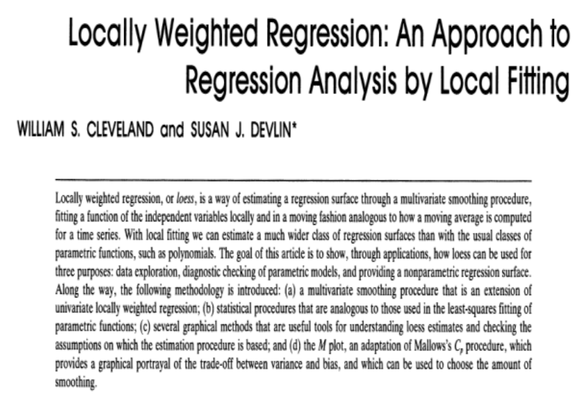
PLI = 1





Global & local efficiency

D – Statistical analysis



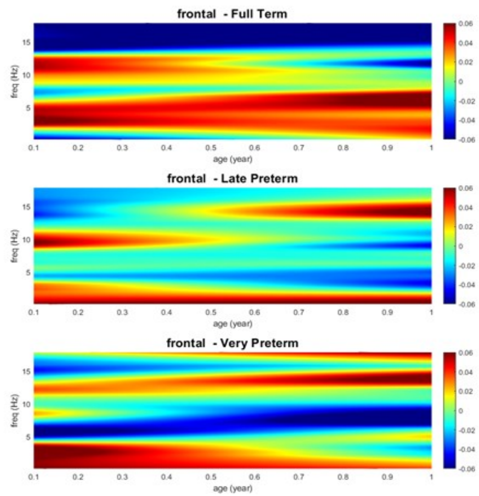
Locally Weighted Regression: An Approach to Regression Analysis by Local Fitting

WILLIAM S. CLEVELAND and SUSAN J. DEVLIN*

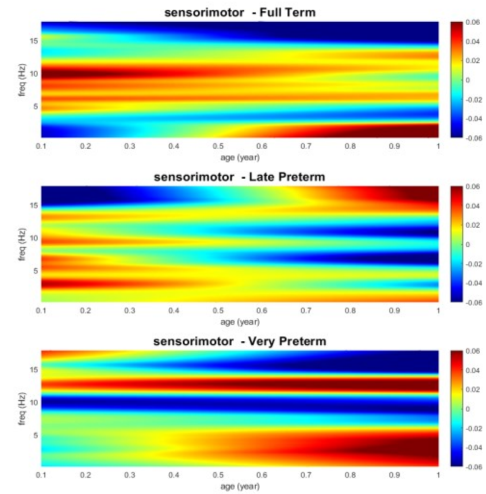
Locally weighted regression, or *loess*, is a way of estimating a regression surface through a multivariate smoothing procedure, fitting a function of the independent variables locally and in a moving fashion analogous to how a moving average is computed for a time series. With local fitting we can estimate a much wider class of regression surfaces than with the usual classes of parametric functions, such as polynomials. The goal of this article is to show, through applications, how loess can be used for three purposes: data exploration, diagnostic checking of parametric models, and providing a nonparametric regression surface. Along the way, the following methodology is introduced: (a) a multivariate smoothing procedure that is an extension of univariate locally weighted regression; (b) statistical procedures that are analogous to those used in the least-squares fitting of parametric functions; (c) several graphical methods that are useful tools for understanding loess estimates and checking the assumptions on which the estimation procedure is based; and (d) the *M* plot, an adaptation of Mallows's C_p procedure, which provides a graphical portrayal of the trade-off between variance and bias, and which can be used to choose the amount of smoothing.

RESULTS

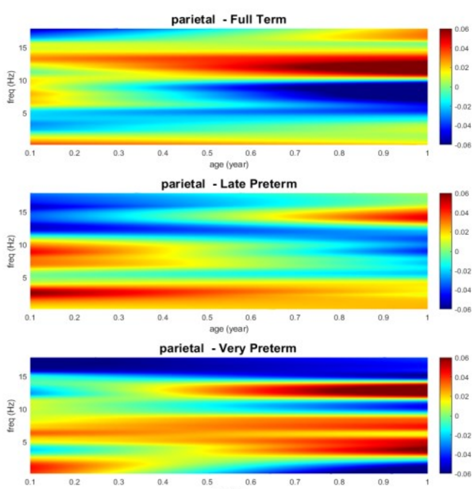
Frontal connectivity



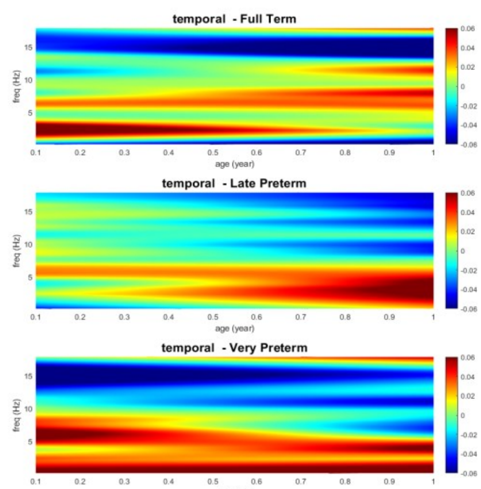
Sensorimotor connectivity



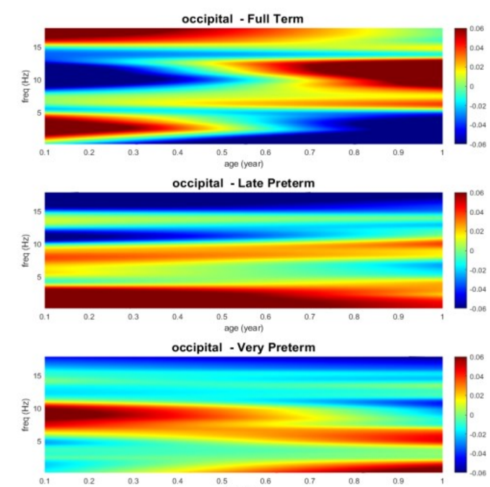
Parietal connectivity



Temporal connectivity



Occipital connectivity



DISCUSSION

- Myelination in preterm infants is severely affected, diffuse white matter injury is one of the most frequent abnormalities observed in preterm infants.
- In the range of 5-8 Hz in full term infants it was possible to see in LRFC a constant increase, as well as in LRTC and LRSC.
- In the alpha band, EEG connectivity in full term infants has a different trend in the different regions.
- EEG beta band connectivity decreases in most brain regions.

CONCLUSIONS

- **A longitudinal study of EEG connectivity during the first year of life in infants was developed.**
- **rsEEG data were selected from a data set of 297 recordings, collected between the years 2016 and 2020.**
- **We estimated the cortical neural activity using the sSSBL method and the connectivity using a phase-lag-based measure.**
- **EEG connectivity in preterm infants was described.**

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Thanks for your attention!!!

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