PINPOINTING PLACEBO RESPONDERS USING ACOUSTIC PSYCHOMETRY

Dan Begel, M.D., AP Systems and Chase Love, University of LaVerne

Objective:
To study the feasabiity of using acoustic analysis of speech to predict placebo responders in a clinical trial.

Method:
Twenty subjects satisfying clinical criteria for depression and scoring greater than 24 on the HAM-D or MADRS were randomized to receive either placebo (N=10) or bupropion sr 100 mg (N=10) for three weeks.

Prior to treatment, two minute recordings of free speech were obtained. Twenty second specimens were extracted. In PRAAT, multiple acoustic features were measured periodically at 10ms intervals.

In MATLAB. simultaneous deltas of all features of phonated speech were computed at 10ms intervals. Dense neighborhoods of paired feature delta values (core) were distinguished from less dense neighborhoods (border).

At three weeks, subjects classified as placebo responder(PR) reported clinical impovement and scored <=15 on the HAMD/ MADRS. Non-responders (PNR) reported minimal improvement and scored >=20.

A principal component analysis was performed yielding 97 variables correlating at >60% with both PR and PNR distributions. Significance tests were performed.

Results:
PR=4 PNR=6.
Initial HAMD/MADRS: mean(SD)PR= 31.5 (2.6), mean(SD)NPR= 31.8 (7.5)
Final HAMD/MADRS: mean(SD)PR=12.3(2), mean(SD)PNR=25.8 (4.5).

Two variables were significant. Variable 1 is the inverse of core pitch/intensity covariance. Variable 2 is the inverse of border pitch/intensity covariance. Lower values reflect tighter linkage of pitch and intensity activity.

Variable 1, mean(SD)PR=154.5 (102.3)
mean(SD)PNR= 39.6 (51.7)
p<.045
Cohen's d=1.42

Variable 2, mean(SD)PR=211.8(143.2)
mean(SD)PNR=54.6(62.8)
p<.043
Cohen's d=1.42

Conclusion:
Acoustic analysis may be a feasible way to predict placebo response. With larger sample sizes and segmented data extraction the method described here lends itself to machine learning offering greater predictive power.

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