



NATIONAL RESEARCH
UNIVERSITY

Mitrofanova Marina

a PROJECT based on the ARTICLE

“Speech Graphs Provide a Quantitative Measure of Thought Disorder in Psychosis”

written by:

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2012

Moscow, 2019

- mental illness can be traced through speech graphs using graph-theoretical tools

- speech graphs - directed 'co-occurrence graphs' of words successively uttered



METHODOLOGY

Speech recordings represented as **graphs** for

- **Schizophrenics**
- **Manics**
- **Controls**

- *Naive Bayes*
- *SVM*
- *Decision Trees*
- *MultiLayer Perceptron*
- *RBF*

Binary Classifiers

Based on

SPEECH GRAPH MEASURES vs **BPRS and PANSS** (scores of two standard psychiatric scales:

nodes

edges

ATD - average total degree

LCC - largest connected component

LSC - largest strongly connected component

PE - parallel edges

L1 - number of loops with one

L2 - two

L3 - or three nodes

Density

Diameter

ASP - average shortest path

- *Brief Psychiatric Rating Scale*

- *Positive and Negative Syndrome Scale)*

RESULTS

SPEECH GRAPH MEASURES →

Naive Bayes (NB) classifier has been shown to provide superior performance based on the quantitative analysis of speech graphs

Schizophrenia x Mania		
Model	AUC	AUC
NB	0.88	0.57
SVM	0.75	0.63
DT	0.81	0.54
MLP	0.88	0.44
RBF	0.98	0.49

← **BPRS and PANSS**

Schizophrenia x Control		
Model	AUC	AUC
NB	0.9	0.84
SVM	0.5	0.81
DT	0.57	0.81
MLP	0.69	0.81
RBF	0.86	0.77

Mania x Control		
Model	AUC	AUC
NB	0.80	0.98
SVM	0.62	0.94
DT	0.19	0.75
MLP	0.37	0.86
RBF	0.59	0.77

OUR AGENDA

- to analyse another mental illness



Depression

PsyHack Hackathon 2019

- **task** - text classification
- **data** - 221 essays of **Depressive/Non-Depressive** people
- **evaluation score** - roc auc

Solution

- represent texts as directed co-occurrence graphs
- compute the mentioned structural properties
- evaluate on the mentioned classifiers

RESULTS

Competition's Top Scores

Decision Trees

N	Имя команды	Precision	Recall	F1	Roc AUC
1	dprssd	0.52	0.93	0.67	0.7666666666666666
2	BigD	0.70	0.63	0.67	0.7551282051282051
3	Student Graduate Descent	0.56	0.80	0.66	0.7538461538461538
4	Fa	0.77	0.57	0.65	0.7448717948717949
5	PsyPredict	0.80	0.53	0.64	0.7358974358974358
6	ME	0.81	0.92	0.86	0.7282051282051282
7	BusyBoys	0.67	0.27	0.38	0.6025641025641025
8	Chillteam	0.68	0.43	0.53	0.6705128205128206
9	Abra	0.39	1.00	0.57	0.6461538461538461
10	Baseline	0.4	0.266	0.32	0.6333
11	Luxury Comedy	0.88	0.23	0.37	0.608974358974359



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Thank you for attention!