24 October 2023

TReNDS Introductory Article

# Foundations

I will need further education in order to properly understand the basis of both my and TReNDS’ work. At present, I have identified the following areas which require focus:

## Information theory and signals analysis

### My understanding of entropy remains inadequate.

#### Entropy

#### Entropy rate

#### Spectral entropy

### I will need additional methods of detecting, quantifying, and estimating signal features.

### Start by identifying terminology of interest

## Dynamic systems analysis

## Network analysis (?)

# Article Goals

This article does not exist in a vacuum. It should serve as a bridge between Ph.D. and postdoctoral work. It should also serve as a catapult which breaks me into the broader research world. Thus, it should:

## Be finalized quickly in order to maintain momentum

## Link to broader TReNDS research

# Immediate Steps (Writing)

## Review current findings

## Read articles on entropy quantification method(s)

## Write an abstract to describe article’s field and findings

## Identify literature of interest

## Write introduction to fill in context and define questions

## Define article goal:

### Validates prior research (which research?)

### Relation to work on signal dynamism

# Later Steps (Writing)

## Explore alternative signal metrics

### Entropy rate

### Spectral entropy

## Explore population-level alterations in subject sFNCs

## Modeling of network transition dynamics

### Markovian / transition matrix? Robyn’s IC dynamics space?

## Identify journals of interest (NeuroImage?)

# Post-Publication Steps

## Harmonize terminology

## Consider novel projects

### Work which excites Vince

### Focus on problem of state space(s) for fMRI dynamics

# Future Projects

## Relationship of clinical scores vs. functional network/imaging metrics

### Any combination of networks track with individual PANSS scores?

### Group of PANSS scores which track network(s)?

## Contact CNS students re: packaging of Deco’s methods

## Merger of data-driven analysis with dynamical model(s)

## Ultimately want end-to-end framework which maps fMRI dynamics to state space

### State space

#### informed by priors

#### captures large area of dynamics

#### Easy to train model(s) in

#### Can be divided along behavioral, clinical, and anatomical dimensions

### Should have some means to compare and harmonize different state spaces

### Ultimately want a universal state space; this possible?