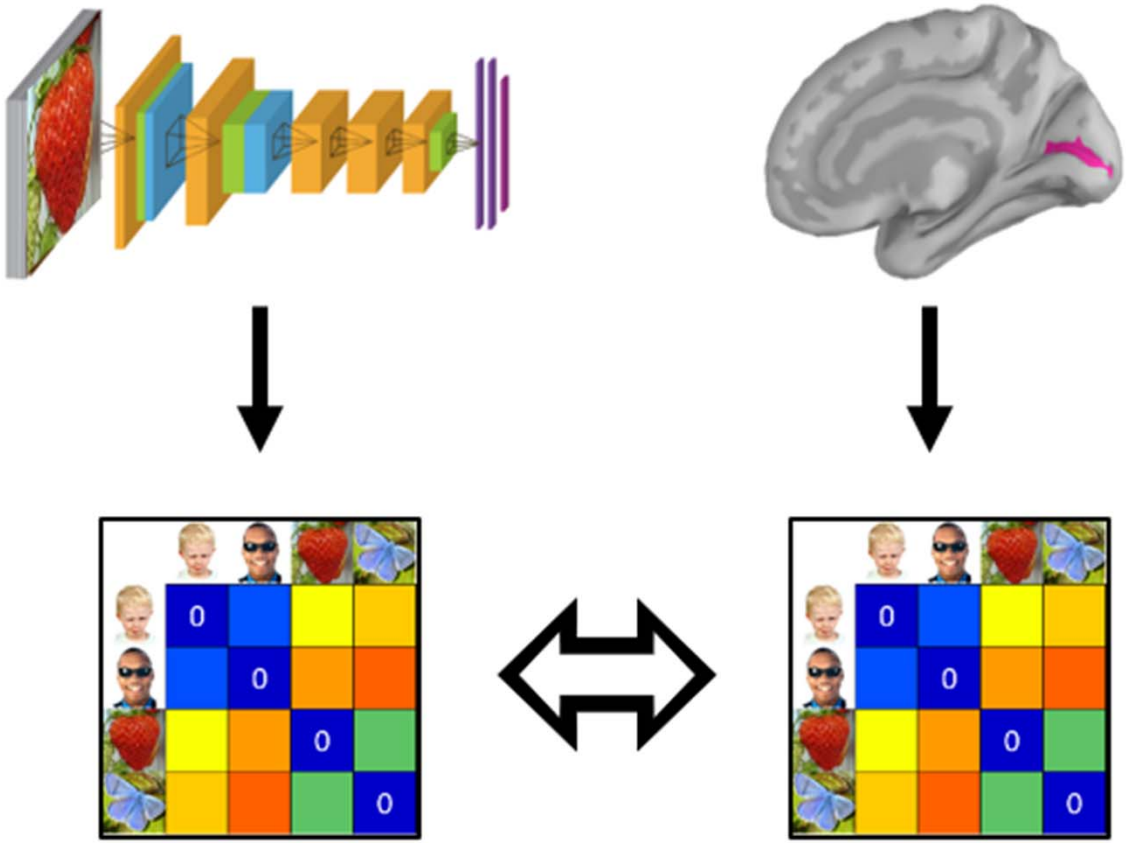
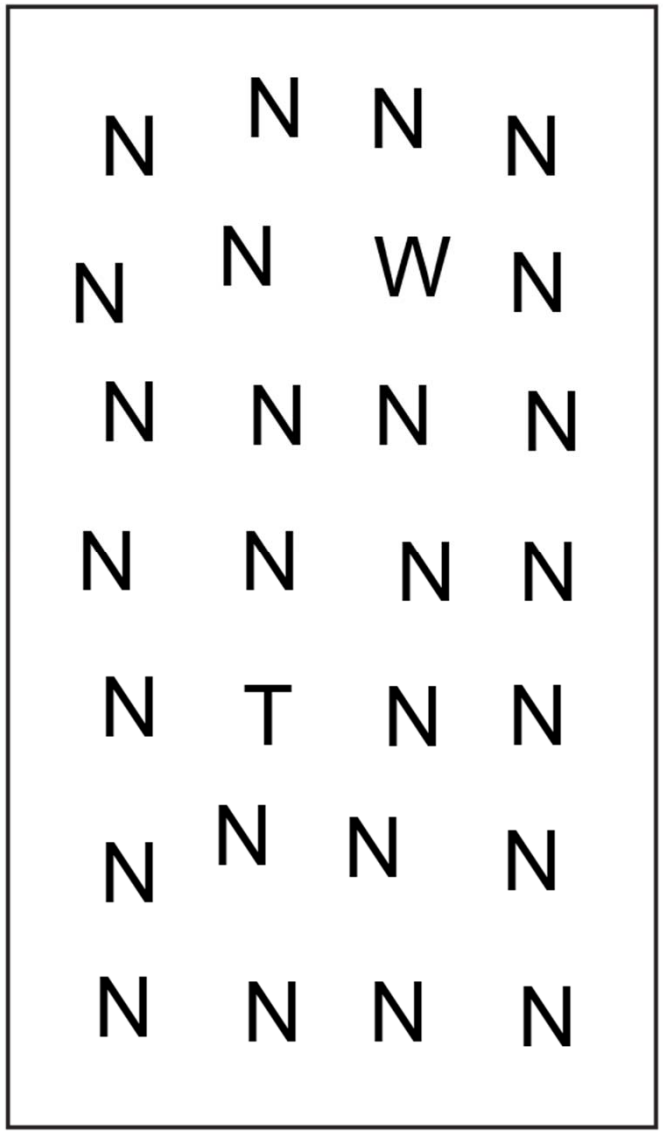
Dissimilarity learning via Siamese network predicts brain imaging data

Aakash Agrawal

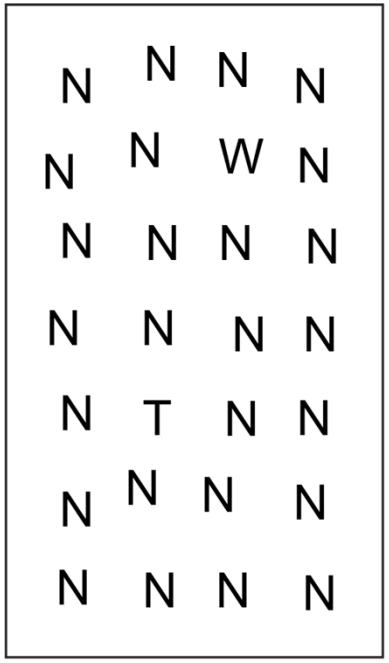
Why Algonauts?



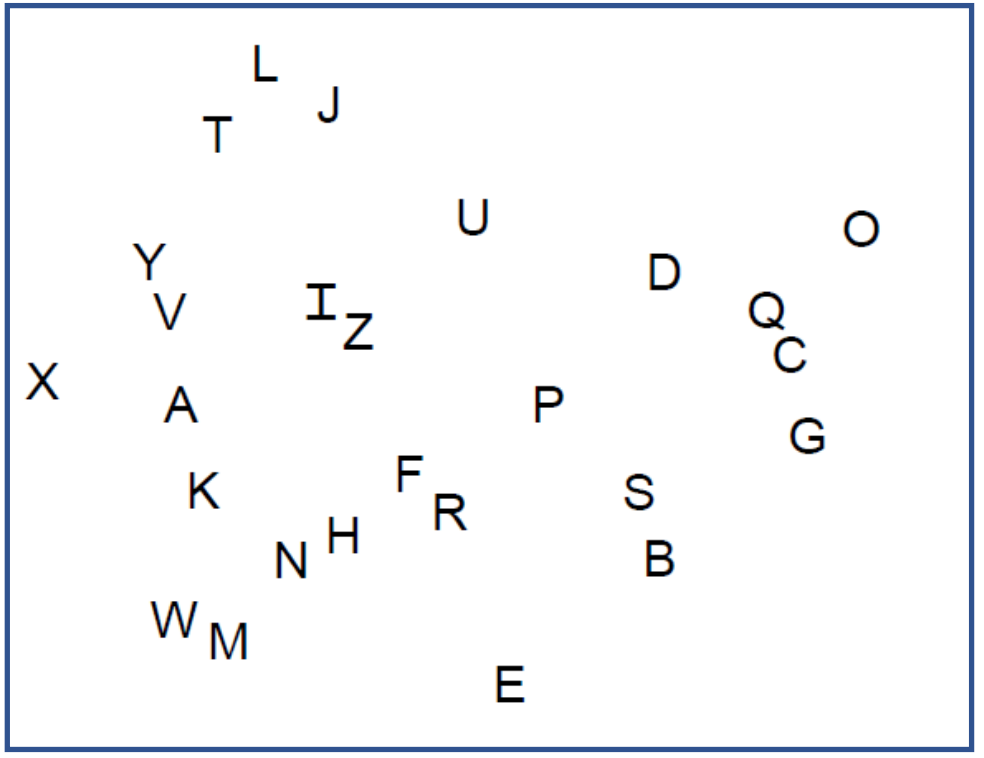

N N N N
N N W N
N N N N
N N N N
N T N N
N N N N
N N N N

Letter representation in the brain

Visual Search



Dissimilarity = 1/response time



Arun 2012

Cold Spring Harbor Laboratory

bioRxiv

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Behaviour

New Results

A compositional shape code explains how we read jumbled words

Aakash Agrawal, K.V.S. Hari, S. P. Arun

Behaviour + fMRI

Cold Spring Harbor Laboratory

bioRxiv

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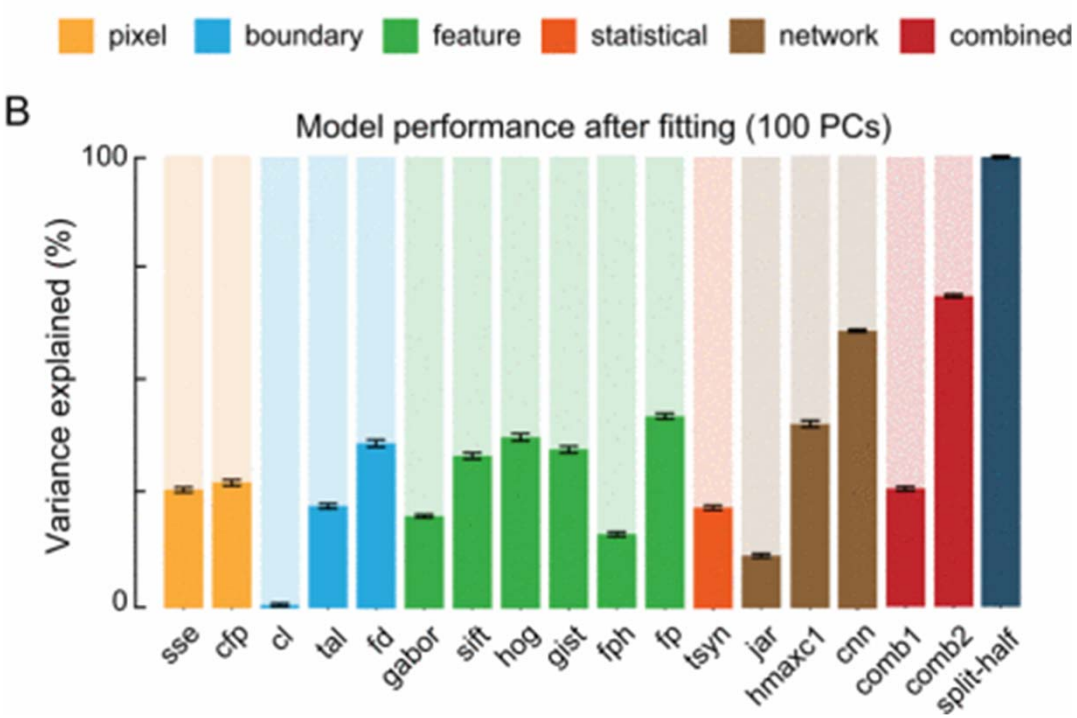
New Results

Comment on

Reading Increases the Compositionality of Visual Word Representations

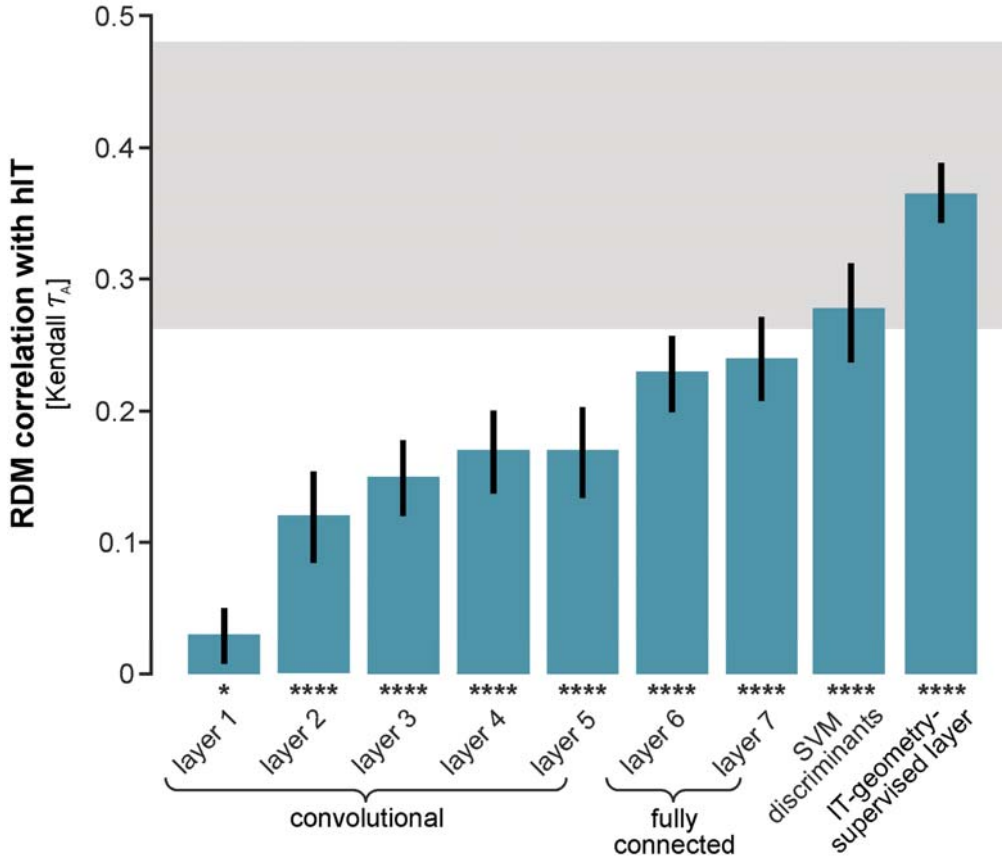
Aakash Agrawal, K.V.S. Hari, S. P. Arun

Behaviour



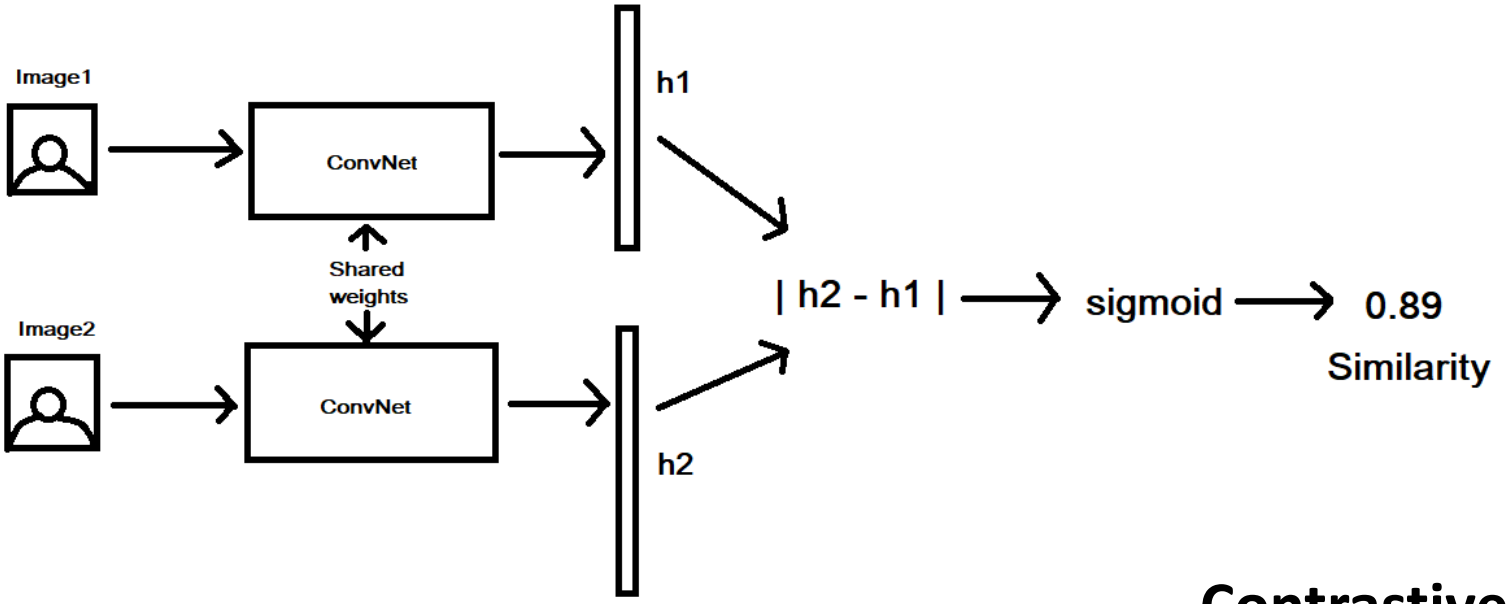
Pramod & Arun, 2016

fMRI



Khaligh-Razavi & Kriegeskorte, 2014

Siamese networks



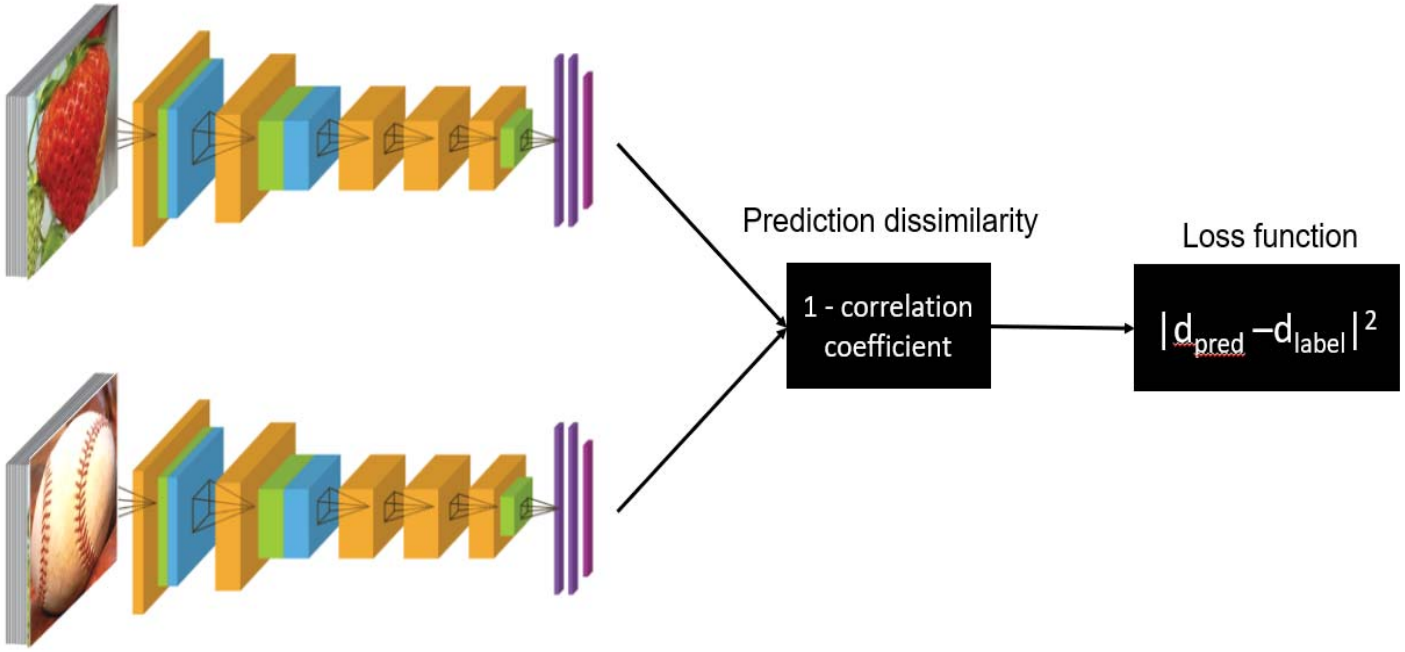
Contrastive Loss

$$L = -(y)\log(p) + (1-y)\log(1-p)$$

where *L* is the loss function,
y the class label (0 or 1) and *p* is the prediction.

https://medium.com

Modified siamese networks

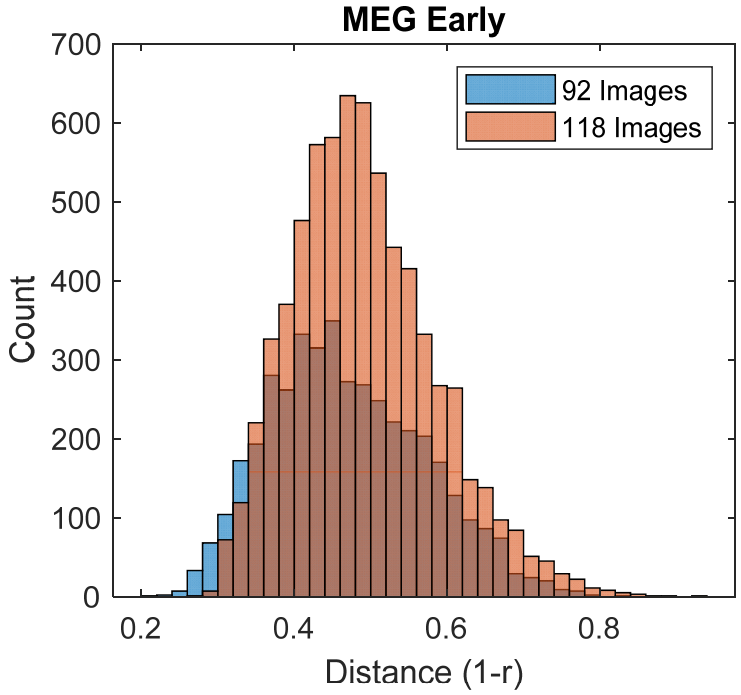


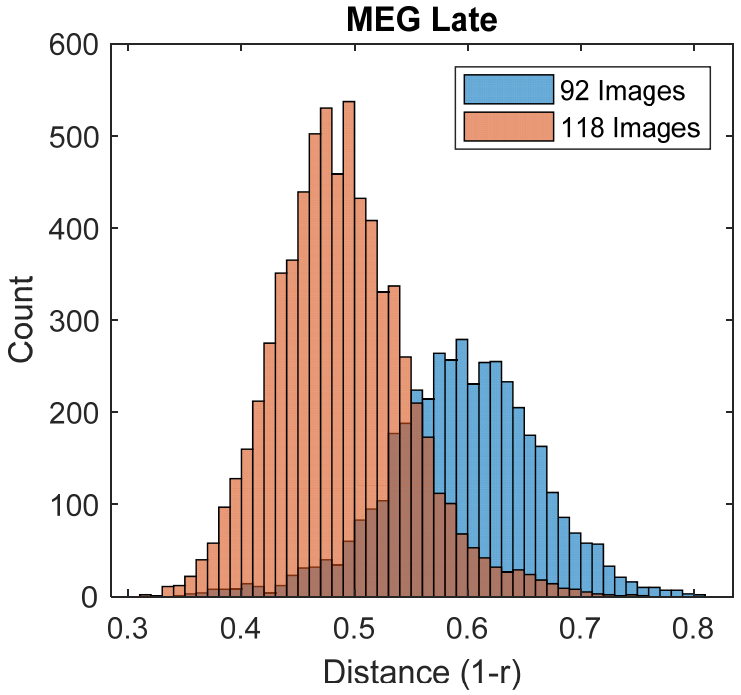
EVC/ MEG early – AlexNet
IT/ MEG late – VGG16

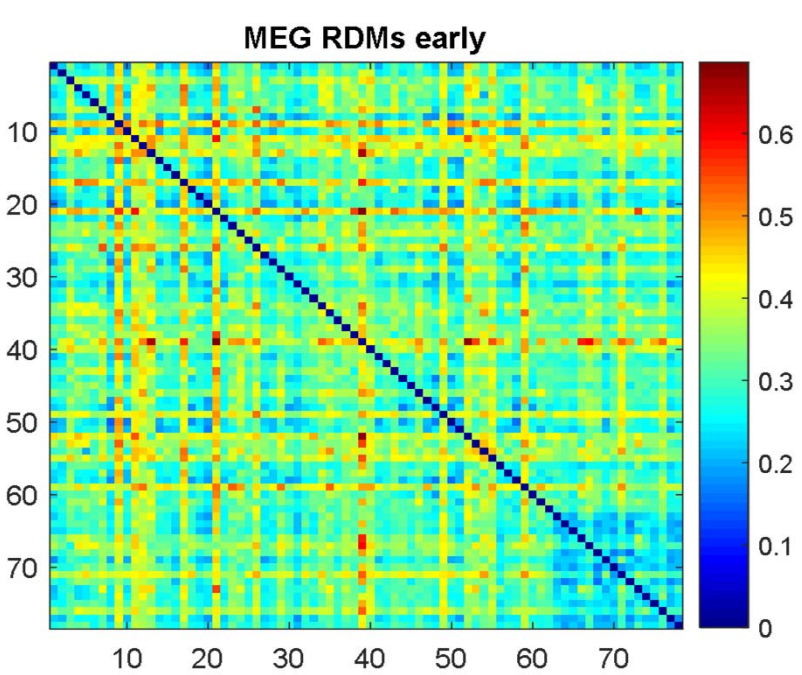
Exploration list

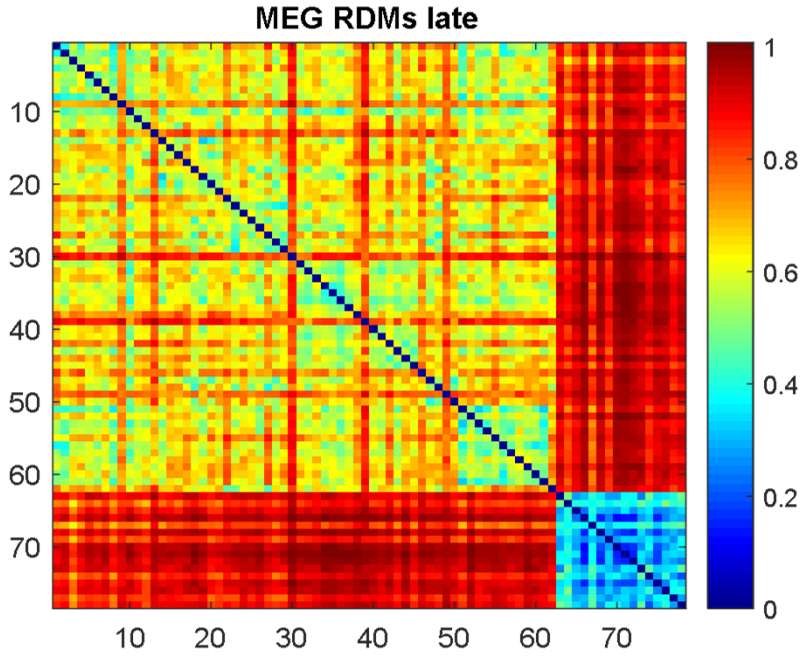
1) Architecture
2) Layers to fine-tune
3) Feature extraction layer
4) Epoch
5) Loss function
6) Training dataset
7) Other hyperparameter – learning rate, batch size, etc.

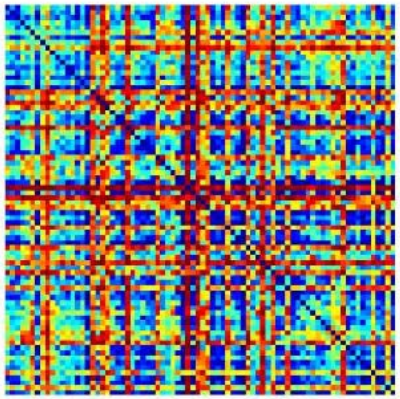
Pre-processing







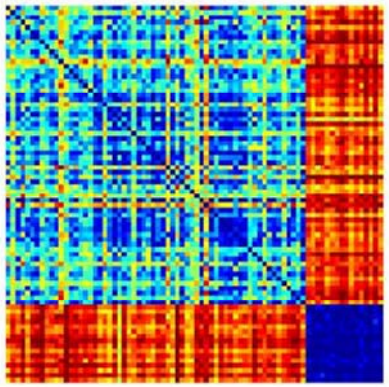




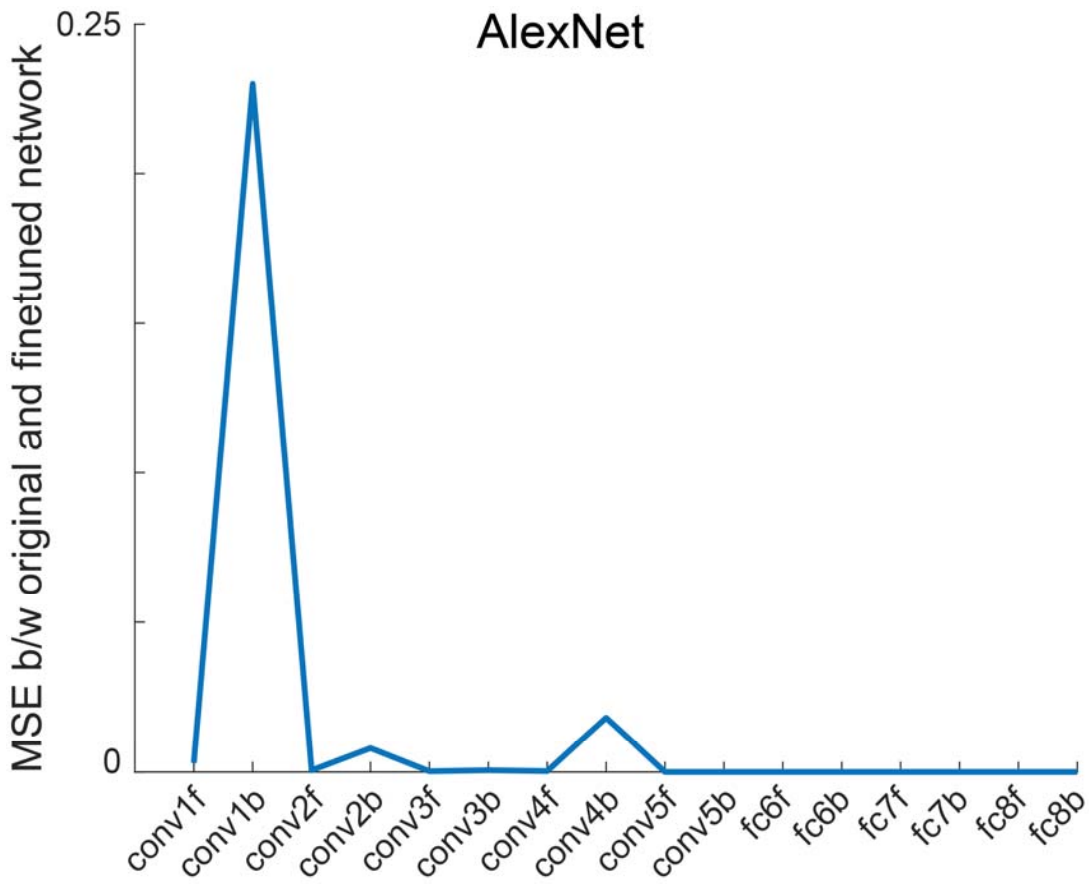
layer 12 from epoch 164
(MEG_early_RDMs)

layer 34 from epoch 13 of
(MEG_late_RDMs)

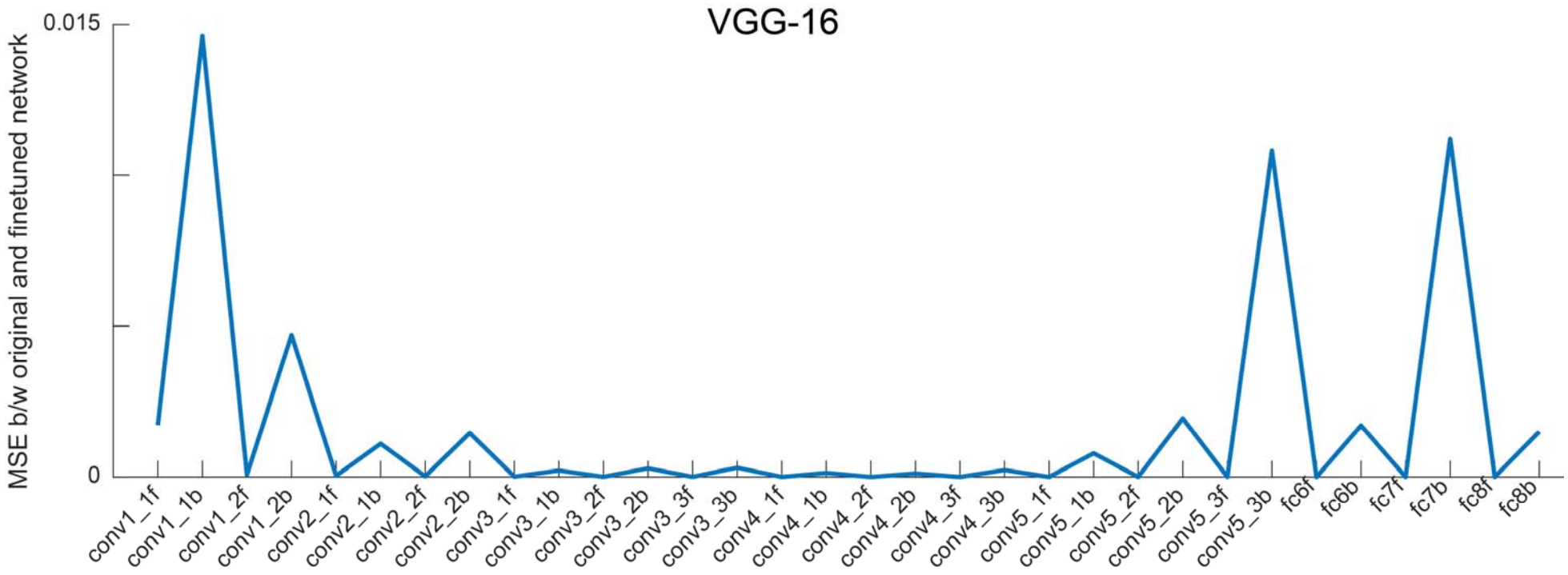
MEG test RDMs



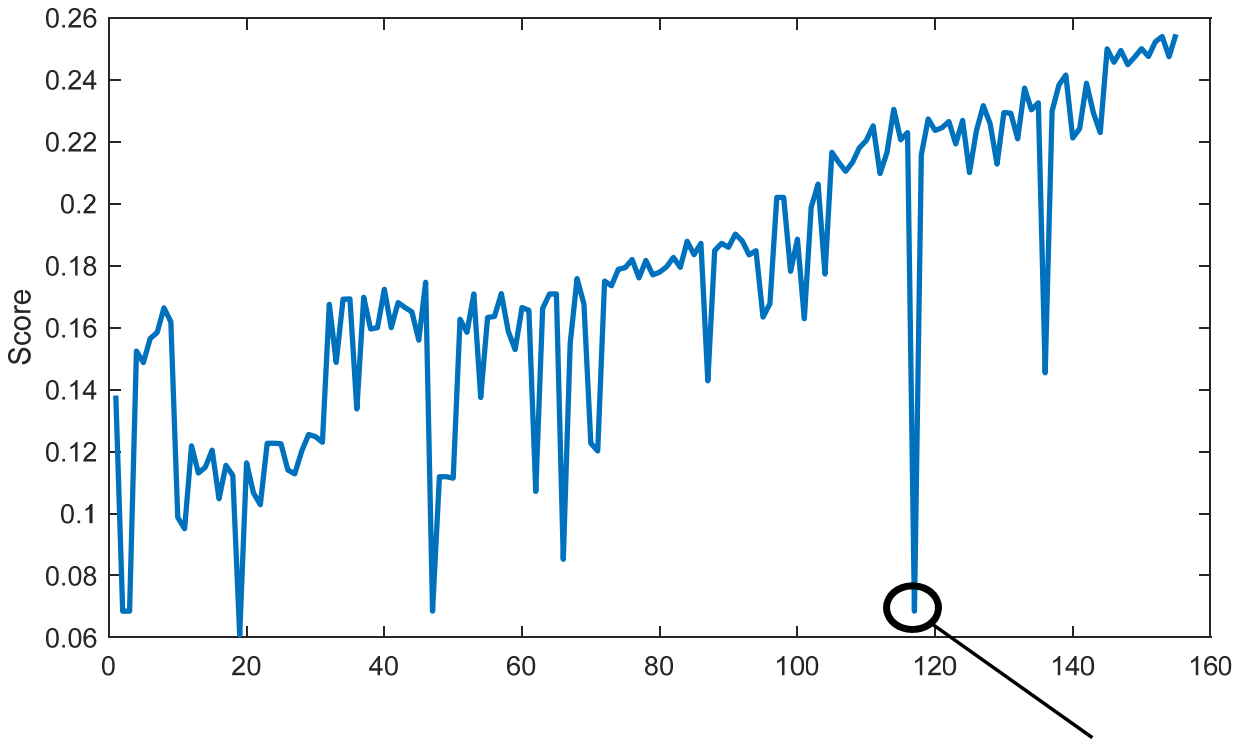
Which layers were affected by fine-tuning?



Which layers were affected by fine-tuning?



Summary



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