Results:

We have concluded a very successful two-year project: 12 journal articles of ours have been appeared in the theme, with a cumulated impact factor of 35.455.

We would emphasize the following results (the references are listed with full details separately):

- We have described deep graph theoretical parameters in the separate lobes of the human brain, highlighting their differences (Cognitive Neurodynamics, Vol. 12, No. 6, pages 549-559),

- We have applied very innovatively the maximum spanning tree method for demonstrating the most important correlations from a large set of pairwise correlations (Brain Imaging and Behavior, 2018), with applications for inhomogeneous brain parameters, including connectomical ones.

- We have analyzed and compared the variability of the connections in the separate lobes of the human brain, with a truly original application of the distribution function, well-known from the probability theory (Neuroscience Letters Vol. 662, pp. 17-21, (2018)).

- Our SECLAF webserver has been appeared in the flagship bioinformatics journal (Bioinformatics, Vol 34, No. 14, pp. 2487-2489 2018, impact factor: 7.3). The webserver applies artificial intelligence tools (deep artificial neural networks) for the prediction of the UniProt or Gene Ontology classifications of proteins, solely from their residue sequences. Our method produces the best predictions to date; it is a very competitive field for more than 15 years now, and today we have the best predictor. The webserver is available at https://pitgroup.org/seclaf/ .

-The Budapest Reference Connectome Server of ours (http://connectome.pitgroup.org) produces the consensus connectome from more than 400 braingraphs, with numerous selectable parameters. By using this server, our former PhD student (who received his doctorate in 2018, and joined the Harvard University, as a post-doc, last December), Csaba Kerepesi, has discovered the phenomenon of the Consensus Connectome Dynamics (CCD), visualized on an animation, based on real data: https://youtu.be/yxlyudPaVUE . We hypothesize that the CCD describes the development of the connections of the human brain. Our article examines this assumption, restricted to the frontal lobe (Neuroscience Letters, Vol. 673, (2018), pp. 51-55), and another article deals with the robustness of the CCD phenomenon, i.e., its independence of the chosen, particular MRI data sets (Scientific Reports, Vol. 7, 16118, 2017). The latter publication shows that the CCD is, indeed, a biological property, and not the feature of the particular datasets examined.

-By using CCD, we were able to assign directions of the edges in the MRI-based human braingraphs, first in the literature. (Balázs Szalkai, Csaba Kerepesi, Bálint Varga, Vince Grolmusz: High-Resolution Directed Human Connectomes and the Consensus Connectome Dynamics, PLOS ONE, Vol. 14 No. 4,: e0215473 (2019), https://doi.org/10.1371/journal.pone.0215473)

- We have presented at several conferences (FEBS 2018, Prague, EB 2018 San Diego) our automatically generated and constantly refreshed amyloid-list from the Protein Data Bank, available at https://pitgroup.org/amyloid/ . A journal article also described this resource (FEBS Open Bio, 2018).

We have mapped the frequently appearing human braingraphs in our publication, first in the literature (Máté Fellner, Bálint Varga, Vince Grolmusz: The Frequent Subgraphs of the Connectome of the Human Brain, Cognitive Neurodynamics Vol. 13, No. 5, pp. 453-460 (2019) https://doi.org/10.1007/s11571-019-09535-y or https://rdcu.be/bAHoe)

- We have mapped the frequent complete subgraphs of the human connectome, first in the literature, in: Máté Fellner, Bálint Varga, Vince Grolmusz: The Frequent Complete Subgraphs in the Human Connectome, In: Rojas I., Joya G., Catala A. (eds) Advances in Computational Intelligence. IWANN 2019. Lecture Notes in Computer Science, vol 11507. pp. 908-920, Springer

-We have introduced the frequent neighborhood mapping method, and applied it in two works, as follows:

Máté Fellner, Bálint Varga, Vince Grolmusz: The Frequent Network Neighborhood Mapping of the Human Hippocampus Shows Much More Frequent Neighbor Sets in Males Than in Females, PLOS ONE 15(1): e0227910 (2020). https://doi.org/10.1371/journal.pone.0227910

Máté Fellner, Bálint Varga, Vince Grolmusz: Good Neighbors, Bad Neighbors: The Frequent Network Neighborhood Mapping of the Hippocampus Enlightens Several Structural Factors of the Human Intelligence on a 414-Subject Cohort, arXiv preprint arXiv:1907.09586; under review in a journal;

Media coverage

Our work, described above, was met with considerable media attention. We think that it is very important to publicize the very nice results of science in popular media, since it reaches wide audiences; much wider ones than the scientific journals, including young and bright high school students, and may attract them to the science and the scientist careers. For this goal we were very active in describing our results in more popular media than the scientific journals, which were followed by non-scientists.

Some more important media appearances in the project duration:

News coverage of our publication: MetaHMM: A Webserver for Identifying Novel Genes with Specified Functions in Metagenomic Samples :

Television report, broadcasted on November 3, 2018, in Novum TV “Hello Tomorrow”:
https://youtu.be/O14ocq7FBjA

https://www.elte.hu/content/webszerverrel-a-genek-nyomaban.t.16644
https://24.hu/tudomany/2018/06/09/magyar-siker-fejlesztes-dns-bakterium-virus/

News coverage of our publication: Mapping Correlations of Psychological and Connectomical Properties of the Dataset of the Human Connectome Project with the Maximum Spanning Tree Method:

https://www.elte.hu/content/pszichologiai-sajatossagok-es-agyi-strukturak.t.17119
http://www.ng.hu/Tudomany/2018/08/11/Pszichologiai-sajatossagok-es-agyi-strukturak

News coverage of our publication: SECLAF: A Webserver and Deep Neural Network Design Tool for Hierarchical Biological Sequence Classification (in Hungarian):

Television report, broadcasted on April 3, 2018, in the magazine “Tudomány minden napra”: https://youtu.be/D3yokTF5mzE

http://www.origo.hu/tudomany/20180302-bioinformatika-ujabb-lepes-a-feherjekutatasban.html
https://www.elte.hu/content/ujabb-lepes-a-feherjekutatasban.t.15978

News coverage of our publication: The Robustness and the Doubly-Preferential Attachment Simulation of the Consensus Connectome Dynamics of the Human Brain

Television report, broadcasted on December 8, 2017 on the first channel of the Hungarian Television, in the “Minden Tudás” magazine: https://youtu.be/oFrOK9elRo4

http://index.hu/tudomany/2017/11/24/magyar_kutatok_jutottak_kozelebb_az_emberi_agy_megertesehez/
http://www.origo.hu/tudomany/20171124-magyar-kutatok-ujabb-lepes-az-emberi-agy-egyedfejlodesenek-feltarasaban.html

News coverage of our publication: The Frequent Subgraphs of the Connectome of the Human Brain: Online articles:

https://www.hirado.hu/tudomany-high-tech/cikk/2019/05/14/az-agy-gyakori-reszgrafjait-azonositottak-az-elte-kutatoi

https://magyarnemzet.hu/belfold/az-agy-gyakori-reszgrafjait-azonositottak-az-elte-kutatoi-6923261/

https://www.origo.hu/tudomany/20190514-az-agy-gyakori-reszgrafjait-azonositottak-az-elte-matematikus-kutatoi.html

https://hvg.hu/tudomany/20190515_elte_pit_matematikusai_agy_reszgrafok_azonositasa
https://infostart.hu/tudomany/2019/05/19/magyar-kutatok-kerultek-kozelebb-az-agy-mukodesenek-megismeresehez

https://www.elte.hu/content/agyunk-gyakori-reszgrafjait-azonositottak-az-elte-kutatoi.t.18890

News coverage of our publication: High-Resolution Directed Human Connectomes and the Consensus Connectome Dynamics:

Television report, broadcasted on May 4, 2019, in “Multiverzum”: https://youtu.be/SH8kumKbAOc

Online articles:
- https://www.origo.hu/tudomany/20190417-agyi-kapcsolatok-iranyitasa.html
- https://ng.hu/tudomany/2019/04/21/agyi-kapcsolatok-iranya/

• https://ttk.elte.hu/content/hogyan-mukodik-az-agy-idegsejthalozata.t.2028
• https://www.elte.hu/content/komoly-elorelepest-tettek-az-agykutatas-teren-az-elte-kutatoi.t.18704

News coverage of our publication: The Frequent Network Neighborhood Mapping of the Human Hippocampus Shows Much More Frequent Neighbor Sets in Males Than in Females:

Online articles:

- https://www.elte.hu/content/miert-gyakoribb-az-alzheimer-kor-a-noknel.t.20528 or cached version
- https://www.origo.hu/tudomany/20200225-az-elte-kutatoi-magyarazatot-talaltak-arra-miert-gyakoribb-az-alzheimerkor-a-noknel.html or cached version
- https://index.hu/techtud/egeszseg/2020/02/25/alzheimer_kor_neurodegenerativ_betegseg_noknel_miert_gyakoribb_hippokampusz_elte/
- https://ng.hu/tudomany/2020/02/26/vajon-miert-gyakoribb-az-alzheimer-kor-a-noknel/ or cached version