International Clinical Research Collaboration

To Impact Society Through Medical Innovation

France (IM2A) – Japan (LABSP)

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HYPERSCANNING: Measuring Simultaneous Brain Activity in Multiple Human Subjects

Research Goals:
• Identify the common brain patterns & profiles in multiple subjects during a socially-engaging shared activity (e.g. emotionally engaging)
• Investigate the pulsed synchronization properties of simultaneous brain signals in all 3 subjects

BRAIN-COMPUTER INTERFACES: For Quadriplegic (Disabled) Patients and Healthy Users

Research Goals:
• Create reliable Brain-Computer interfaces (BCI) (using visual flicker stimulation) with high success rate (98-99%), high number of commands (8 to 12), short delays (1-3s), and no need for training before usage
• Achieve improvement of the BCI command performance by introducing emotional- instead of neutral stimuli (speed, reliability)
• Develop BCI using a multi-joint robotic arm for disabled users with 8 preset possible actions

MUSIC THERAPY: Long-Term Memory Enhancement in Dementia (Alzheimer's Disease)

Research goals:
• Study brain changes induced by music therapy in elderly dementia (using whole-head EEG recording (before, during, after therapy), psychological exams)
• Optimize music therapy using neurotechnology to prolong the positive effects and automate procedure for home settings

Keiichi Ishibashi Music Therapist
GOALS
• Detect Preclinical Alzheimer’s Disease (PrAD) years/decades before clinical manifestation
• Create & validate clinical PrAD biomarkers for preventive and therapeutic trials

CHALLENGES
• Difficult to distinguish normal healthy elderly subjects from clinically ‘healthy’ subjects with Preclinical Alzheimer’s Disease
• AD mechanisms not fully understood
• Existing AD biomarkers reflect limited aspects of pathology and disease stage - new approaches are needed

TARGETS
• Addressing difficult challenges by integration of multidisciplinary expertise
  – LABSP: Extraction of hidden components from data using multimodal tensor decomposition
  – IM2A: Clinically well-characterized elderly subject groups; Selection and weighting of medical factors and exams for analysis; Overall analysis of results

INSIGHT-AD STUDY

Step 1
(Multimodal Data & Profiles)

CLINICAL
SUBJECT INFO
NEUROLOGY
NEUROPSYCHOLOGY

NEURO-BIOLOGY
BLOOD biomarkers
CSF biomarkers

NEURO-DYNAMICS
EEG
ACTIGRAPHY

NEURO-IMAGING
STRUCTURAL MRI
FUNCTIONAL MRI
DWI
ASL
PET-AV45
PET-FDG

Step 2
(Biomarkers → Predictive algorithm → Application)

THERAPEUTIC TRIALS
AD OUTCOME PREDICTION
EXTRACTED BIOMARKERS
DATA FEATURES
RAW DATA

Innovative Joint Perspectives for Future Collaborative Research:
• Multidimensional component analysis to determine hidden risk- and diagnostic factors for AD
• Iterative retrospective optimization of the clinical PrAD biomarkers during the course of the longitudinal study (5-7 years with annual data points)
• Advanced data mining of the results of preventive and therapeutic trials
QUESTIONS?

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LABSP : http://www.bsp.brain.riken.jp