Journée FéDeV 2017
Jeudi 9 Novembre 2017

La journée s'est tenue sur le campus de l'Université de Versailles Saint-Quentin-en-Yvelines à l'IUT de Vélizy, 10-12 Avenue de l'Europe, 78140 Vélizy-Villacoublay

PROGRAMME

8h15 : Arrivée Organisateurs
8h45-9h00 : Accueil du Conseil de Fédération
9h00-10h00 : Réunion Conseil de Fédération

9h30-10h10 : Accueil public / Pause café
10h10 : Discours d'ouverture de la Journée FéDEV 2017 ***(A. Constantin, VP Recherche de l'UVSQ).***

10h15-11h00 : Conférence plénière

« Ghosts, neuroscience, and robotic psychiatry »
by Olaf Blanke

Bertarelli Foundation Chair in Cognitive Neuroprosthetics
Director, Center for Neuroprosthetics
Professor, Brain-Mind Institute, EPFL
Professor, Department of Neurology, University of Geneva

Abstract: Tales of ghosts, wraiths, and other apparitions have been reported in virtually all cultures. The strange sensation that somebody is nearby when no one is actually present and cannot be seen (feeling of a presence, FoP) is a fascinating feat of the human mind, and this apparition is often covered in the literature of divinity, occultism, and fiction. Although it is described by neurological and psychiatric patients and healthy individuals in different situations, it is not yet understood how the phenomenon is triggered by the brain.

I will describe several cases of the FoP in neurological patients, suggesting that the FoP is caused by abnormal processing of sensorimotor signals. Based on these clinical data and recent experimental advances of multisensory own-body illusions, we designed a master-slave robotic system to generate specific sensorimotor conflicts at the trunk enabling us to induce the FoP and related illusory own-body perceptions experimentally in normal participants. Further lesion analysis in neurological FoP patients,

supported by an analysis of associated neurological deficits show that the FoP is an illusory own-body perception with well-defined characteristics and associated with sensorimotor loss and caused by lesions in three distinct brain regions: temporo-parietal, insular, and especially frontoparietal cortex. These data show that the illusion of feeling another person nearby is caused by misperceiving the source and identity of sensorimotor (tactile, proprioceptive, and motor) signals of one's own body.

In the last part of my talk I will describe our recent work in patients suffering from schizophrenia. We investigated the effects of sensorimotor robotic stimulation on auditory verbal perception and found that especially patients with so called first-rank symptoms (positive symptoms, hallucinations, delusions) are vulnerable to robotic stimulation, associated with changes in gamma oscillations within a distributed cortico-subcortical network. I will conclude by discussing the subtle balance of sensorimotor brain mechanisms that generate the experience of ''self'' and ''other,'' and argue that robotic psychiatry in association with neuroimaging may significantly advance efforts for the diagnosis and also the treatment of positive symptoms in schizophrenia and other neurological diseases.

11h00-11h45 : Conférence plénière

« Sensorimotor interactions in humans and in robots: a prelude to humanoid robotic science »

by Gordon Cheng

Professor, Institute for Cognitive Systems
TUM Department of Electrical and Computer Engineering
Technical University of Munich, Germany

Abstract: Considerable commonalities can be drawn from the sensorimotor interactions between humans and robots, driving research in both fields. The scientific understanding of human motor control is moving beyond simply being a pure inspiration for the derivation of impressive robot controls, and actually changing the techniques used in robotic systems. Moreover, methods in robotics are providing better models of human motor control science. Recent interactions between the sciences of human sensorimotor control and robotics are taking a new leap to provide new and innovative benefits in both fields. In this talk I will draw on several examples in humanoid robotic science to illustrate some of these new directions, findings and discuss future possibilities.

11h45-12h30: Table Ronde avec les conférenciers invités, sur la complémentarité SDV/STIC autour des questions de "embodiment in human-robot interaction"

Participants :

Eric Brunet-Gouet,
Praticien hospitalier en psychiatre adulte
Laboratoire HANDIReSP, UVSQ,
Centre Hospitalier de Versailles

Samer Alfayad,
Chaire d'excellence industrielle sur la domestication hydraulique,
LISV, UVSQ

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Aurélien Vauquelin,
PDG d'Eraclès-Technology,

et **Gaël Guilhem**,
Directeur du laboratoire SEP de l'INSEP

12h30 – 12h45 : Annonce des posters (« booster »)
12h45-14h00: Déjeuner-Buffet / Posters-Démos

14h00-16h15: Communications orales ***(cf. Résumés à partir de la page 5 de ces Actes)***

Auteurs	Intitulé	Thématique FéDeV
***MacIntosh, A.**, Hoskin, E., Biddiss, E., Vignais, N., & Vigneron, V. **(14h00-14h15)**	Recognizing hand movements for serious games using low-cost electromyography to improve hand function of youth with cerebral palsy *[IBISC, CIAMS, collab. Toronto, Canada]*	Mobilité et activité physique
Bouyer, G., Chellali, A., & Lecuyer, A. **(14h15-14h30)**	Inducing self-motion sensations in driving simulators using force-feedback and haptic motion *[IBISC, collab. INRIA]*	Mobilité et activité physique
Martin, J-C., Demulier, V., & Clavel, C. **(14h30-14h45)**	Outils pour un coach sportif virtuel personnalisé sur montre connectée *[LIMSI]*	Mobilité et activité physique & Interaction sociale et communication
***Garrec, E.**, Roche, N., & A. Siegler, I.A. **(14h45-15h00)**	Adaptations motrices et spinales liées à une tâche visio-motrice rythmique *[CIAMS, END-ICAP]*	Mobilité et activité physique
***Pouvrasseau, F.**, Monacelli E., & Charles S. **(15h00-15h15)**	Etat de l'art des simulateurs de fauteuils roulant et présentation du simulateur Virtual Fauteuil *[LISV]*	Mobilité et activité physique
***Yang, Y-F.**, Brunet-Gouet, E., Burca, M., Kalunga, E., & Amorim, M-A. **(15h15-15h30)**	Brain response to photo and sketch faces when categorizing emotional expressions *[CIAMS, HANDIReSP, LISV]*	Interaction sociale et communication
***Kahindo, C.**, El-Yacoubi, M.A., Garcia-Salicetti, S., Cristancho-Lacroix, V., & Rigaud, A-S. **(15h30-15h45)**	Analysis of spatiotemporal dynamics of handwriting for characterizing Alzheimer's disease *[SAMOVAR, collab. AP-HP Hôpital Broca & EA 4468]*	Interaction sociale et communication
***Briquet-Kerestedjian, N.**, Makarov, M., Grossard, M., & Rodriguez-Ayerbe, P. **(15h45-16h00)**	Stratégies pour la détection d'impact – Application à l'interaction homme-robot sûre *[L2S, LRI du CEA-LIST]*	Homme artificiel bio-inspiré
***Orefice, P.-H.**, Ammi, M., Hafez, M., & Tapus, A. **(16h00-16h15)**	Interpersonal handshake study for emotion recognition in social robotics *[U2IS, LIMSI, LISA du CEA-LIST]*	Interaction sociale et communication

* Candidat(e)s retenu(e)s pour concourir au *Prix Demenÿ-Vaucanson*

16h15-16h30: Pause café / Posters-Démos
16h15-16h30 : Réunion du Comité de Pilotage (Prix Demenÿ-Vaucanson)
16h30-17h00 : Remise des *Prix Demenÿ-Vaucanson* autour d'un cocktail

17h00 : Clôture

POSTERS

Auteurs	Intitulé	Thématique FéDeV
Bastide, S., Vignais, N., Geffard, F., & Berret, B.	Etude des mouvements du coude avec et sans exosquelette *[CIAMS, LRI du CEA-LIST]*	Homme artificiel bio-inspiré
Teulier, C., Hinnekens, E., & Berret, B.	Does a bilateral synergies hypothesis allow a better simplification of control in human locomotion? *[CIAMS]*	Mobilité et activité physique
Hafsia, M.	La Réalité Virtuelle comme outil de formation à la santé et à la sécurité *[LISV]*	Mobilité et activité physique
Agrigoroaie, R., & Tapus, A.	Defining the user profile for the behavior adaptation of a robot *[U2IS]*	Interaction sociale et communication
Amroun, H., Temkit, M., & Ammi, M.	Étude des comportements de téléspectateurs avant, pendant et après le visionnage d'un programme TV en utilisant un réseau d'Objets connectés *[LIMSI, collab. Mayo Clinic-Arizona]*	Interaction sociale et communication
Guedira, Y., Desailly, E., Farcy, R., & Bellik, Y.	Evaluation cinématique d'une interface tactile pour le pilotage d'un fauteuil roulant électrique : une étude pilote *[LIMSI, Fondation E. Poidatz, collab. LAC]*	Mobilité et activité physique
Bobin, M., Anastassova, M., Boukallel, M., & Ammi, M.	Objets connectés pour l'analyse de l'activité motrice pendant les séances de rééducation post-AVC *[LIMSI, LISA du CEA-LIST]*	Mobilité et activité physique
Richard, P., Burkhardt, J.-M., & Lubart, T.	La participation des usagers à la conception créative de solutions de mobilité en France. Premier état des lieux et perspectives *[LPC-IFSTTAR, collab. LATI-Univ.Paris Descartes]*	Mobilité et activité physique
Montuwy, A., Cahour, B., & Dommès, A.	Informations de guidage visuelles, auditives et haptiques pour les piétons âgés *[LEPSIS-IFSTTAR, collab. LTCI-Telecom ParisTech]*	Mobilité et activité physique
De Bois M., Amroun H., & Ammi, M.	Estimation des dépenses énergétiques quotidiennes par la reconnaissance des activités physiques sur un smartphone *[LIMSI]*	Mobilité et activité physique
Espié S., Boubezoul, A., et al.	VIROLO++ : Étude approfondie des pratiques de prise de virages en moto : vers des outils d'évaluation et de (ré)entraînement *[SIMU&MOTO-IFSTTAR, IBISC, et autres collaborations]*	Mobilité et activité physique
Rabreau, O., & Monacelli, E.	Projet PLEIA : Plateforme Logicielle d'Evaluation des Interfaces et des Assistances *[LISV]*	Mobilité et activité physique

Recognizing Hand Movements for Serious Games using Low-Cost Electromyography to Improve Hand Function of Youth with Cerebral Palsy

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Résumé

Background: Cerebral Palsy (CP) is a neuromuscular condition that affects 1 in 400 children from birth[1]. CP can limit one's daily activities that involve reaching and grasping. Serious games can provide a motivational and flexible environment in which to practice[2]. Additionally, electromyography (EMG) offers detailed information that can be used to control games. However, EMG characteristics classically used for gesture recognition have not been used to recognize gestures for people with CP. As such, we must develop accurate methods of recognizing therapeutic movements. Doing so will help youth with CP practice therapeutic movements through serious games.

Objective: To evaluate the efficacy of a classification algorithm dedicated to recognizing wrist extension and pinching movements towards developing a real-time serious game therapy for youth with CP.

Methods: Five participants (two females) age 17-23 years with hemiplegic CP participated. During testing, participants completed calibration tests (15 repetitions * 3 trials * 4 gestures) and played a serious game for 10 minutes using low-cost EMG sensors (Myo Armband). Calibration tests served to train a classification algorithm of four manually coded actions (rest, closed-hand wrist extension, open-hand wrist extension, thumb-finger pinching). Gestures were classified using a support vector machine (SVM) algorithm based on spatial and temporal features of the 8-channel EMG, accelerometer and gyroscopic data. Results were compared to manual coding.

Results: Classification performance across all gestures averaged an F1 score = 72$\pm$19%. Classification performance was highest for the rest gesture (F1 score = 95$\pm$3%) and lowest for thumb-finger pinching (F1 score = 60$\pm$21%). Performance varied depending on severity of hemiplegia and the amount of time participants maintained each posture.

Conclusion: The current findings support the value of low-cost EMG for identifying wrist extension and pinching movements. The continued analysis will aim to improve the reliability and robustness of the algorithm. With a classification method that detects wrist extension and grasping movements, youth with CP can play therapeutic games.

Références

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Inducing Self-Motion Sensations in Driving Simulators using Force-Feedback and Haptic Motion

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Abstract

Producing sensations of motion in driving simulators often requires using cumbersome and expensive motion platforms. In this article we present a novel and alternative approach for producing self-motion sensations in driving simulations by relying on haptic feedback.

The method consists in applying a force-feedback proportional to the acceleration of the virtual vehicle directly to the hands of the driver, by means of a haptic device attached to the manipulated controller (or a steering wheel). We designed a proof-of-concept based on a standard gamepad physically attached at the extremity of a standard 3DOF haptic display. Haptic effects were designed to match notably the acceleration/braking (longitudinal forces) and left/right turns (lateral forces) of the virtual vehicle.

A preliminary study conducted with 23 participants, engaged in gamepad-based active VR navigations in a straight line, showed that haptic motion effects globally improved the involvement and realism of motion sensation for participants with prior experience with haptic devices. Our results suggest that our approach could be further tested and used in driving simulators in entertainment and/or professional contexts.

A new prototype including a pedalboard, a 3D printed wheel and a virtual reality helmet has been developed in order to be evaluated in more complex trajectories.

Reference

Guillaume Bouyer, Amine Chellali, Anatole Lécuyer. Inducing self-motion sensations in driving simulators using force-feedback and haptic motion. VR 2017 - 19th IEEE Virtual Reality, March 2017, Los Angeles, United States. IEEE, pp.84-90, 2017, Proc. of the 19th IEEE Virtual Reality (VR 2017).

Outils pour un coach sportif virtuel personnalisé sur montre connectée

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Résumé

Un nombre croissant d'études montre que l'activité physique peut être une intervention pour la prévention et le traitement de problèmes de santé mentale et physique. La recherche dans les objets connectés et les technologies persuasives suggère qu'un coach destiné à promouvoir les activités physiques doit fournir une interaction personnalisée. Nous présentons un framework pour la conception d'un coach virtuel qui favorise l'activité physique et prend en charge les interactions entre l'utilisateur et une montre connectée qui sont: 1) personnalisées et adaptées à l'utilisateur, 2) dynamiques (lors d'une activité physique), et 3) multimodales (graphisme, texte, audio et vibration). Les recherches envisagées avec ce cadre technologique sont discutées, notamment pour l'aide à la gestion du stress et le changement de comportement grâce à des messages motivationnels personnalisés prenant en compte la personnalité de l'utilisateur (traits OCEAN, regulatory focus).

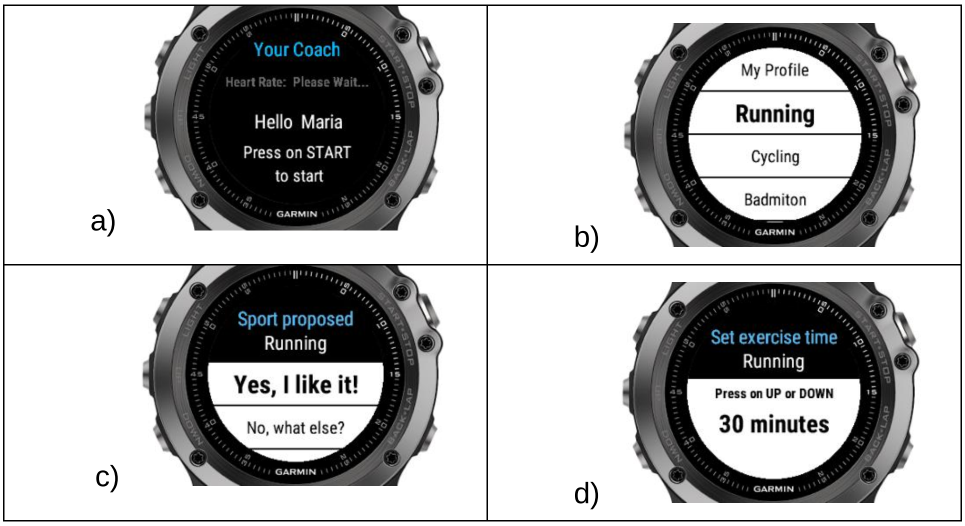

Fig. 1. Personalized interaction before an activity starts: a) WE-nner displays a personalized message including user's name, b) it suggests several activities, c) the user is able to select the activity she wants to do, and d) the activity is ready to start.

Références

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Adaptations motrices et spinales liées à une tâche visio-motrice rythmique

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Résumé

Introduction : La réalité virtuelle peut permettre de proposer des taches motrices multiples et variées. Elle est intéressante comme outil de rééducation/réhabilitation, car elle permet d'augmenter la pratique répétée d'exercices adaptés tout en enregistrant leur réalisation, ce qui permet d'objectiver la performance. Elle présente comme autre avantage de permettre des conditions de pratiques facilement modifiables [1]. Les circuits neuronaux spinaux (CNS) modulent l'excitabilité des motoneurones α, qui sont la voie finale commune de toute activité motrice. Ces circuits sont, comme l'ensemble des réseaux neuronaux, doués de plasticité, c'est-à-dire qu'ils sont capables de se modifier, d'adapter leur comportement sous l'effet des contraintes de l'environnement. Ainsi, modifier le comportement des CNS permettrait d'améliorer les fonctions motrices, en particulier chez les patients présentant un comportement altéré des CNS tels que les porteurs de lésion du système nerveux central [2]. L'objectif de cette recherche est de développer les connaissances sur les adaptations des CNS cervicaux induites par la réalisation d'une tâche visio-motrice rythmique d'un MS.

Méthodes : Seize sujets sains ont été inclus. Tous les sujets ont réalisés deux fois la tâche visio-motrice, une fois avec chaque membre supérieur, avec au minimum une semaine d'intervalle entre les deux sessions. La tâche utilisée dans notre étude est la frappe cyclique de balle [3] ; elle consiste à faire rebondir une balle virtuelle en l'actionnant avec un capteur simulant une raquette. La performance à la tâche est évaluée par l'erreur de rebond qui représente la différence entre l'apex de la balle et la hauteur-cible à atteindre, elle est mesurée à chaque rebond. Les CNS sont explorés par l'étude des modifications d'amplitude du réflexe monosynaptique (réflexe d'Hoffman ou réflexe H). Les CNS ont été enregistrés immédiatement avant et immédiatement après la réalisation de seize essais de 30 secondes de la tâche.

Résultats : L'analyse de la performance de la tâche a permis de séparer les sujets dans deux groupes d'adaptation. Le groupe des adaptés montre une amélioration significativement différentes de l'écart-type de l'erreur de rebond au fur et à mesure des essais. En ce qui concerne les CNS, il n'existe aucune différence significative pré-post-tâche, quelle que soit la latéralité du sujet, et quel que soit le groupe d'adaptation des sujets.

Interprétation : La tâche n'a eu aucun effet sur les différents CNS. Pour autant, il est intéressant de proposer une nouvelle étude reprenant la tâche de frappe cyclique de balle, en rendant celle-ci plus complexe. Ainsi, des variations répétées des caractéristiques de la tâche devraient pousser les sujets à s'adapter.

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Etat de l'art des simulateurs de fauteuils roulant et présentation du simulateur Virtual Fauteuil

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Résumé :

L'utilisation d'un simulateur de fauteuil roulant peut avoir plusieurs fonctions :

Le premier est de proposer un dispositif d'entrainement sécurisé qui permet à son utilisateur d'évoluer avec son propre fauteuil roulant dans un environnement de réalité augmentée sous le contrôle d'un thérapeute qui peut choisir plusieurs scenarii et niveaux d'intensité en fonction du patient.

Le deuxième objectif vise à proposer aux personnes valides (des décisionnaires de collectivités publiques par exemple) une initiation aux problématiques de mobilité auxquelles les personnes handicapées sont confrontées afin de les sensibiliser et de mieux leur faire prendre conscience des conséquences de leurs choix en matière d'aménagement des territoires.

Le dernier objectif est de permettre la simulation d'accès à des structures publiques en vue de vérifier qu'elles répondent bien aux normes imposées par les lois locales et internationales. Ainsi, il est possible d'explorer virtuellement des aménagements urbains afin de vérifier qu'ils répondent bien aux normes, de tester plusieurs configurations et de rechercher des solutions d'amélioration. Mais dans un sens plus large, le simulateur permet d'évaluer la pénibilité et la faisabilité de chaque trajet.

Virtual Fauteuil s'inscrit donc naturellement dans les problématiques actuelles de mobilité en offrant des possibilités d'évaluation des aménagements des lieux publics, ainsi que de proposer aux personnes récemment handicapées ou ayant eu une expérience traumatisante lié à l'usage de fauteuil roulant un simulateurs d'entrainement avec un panel d'exercices personalisés couvrant tout les gestes du quotidien, et toutes les difficultés.

Le simulateur se veut immersif, car il couple au rendu visuel, des retours haptiques grâce à une plateforme muni de 4 vérins qui contrôlent en temps réel la pente et le devers du plateau sur lequel est placé le fauteuil roulant de l'utilisateur et aussi par le biais de rouleaux motorisés qui produisent des retours d'effort au niveau des roues arrières du fauteuil.
Je travail sur le simulateur Virtual Fauteuil pour mes travaux de thèse.

L'objectif de ma thèse est concevoir un système de diagnostic de la posture afin de déceler pendant une simulation si l'utilisateur a adopté une bonne posture, et sinon, comment la corriger.
Une mauvaise posture est souvent dangereux pour un usager de fauteuil roulant sur le long terme. Cela peut, entre autre, entraîner des troubles musculoquelettiques aux membres supérieurs.

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Brain response to photo and sketch faces when categorizing emotional expressions

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1. Résumé

An upside-down face leads to a disrupted holistic processing in face perception increasing the N170 event-related potential (ERP) component. Thereby the inversion effect on N170 is similar between neutral photo and sketch faces during passive viewing [1]. Yet, the effect of stimulus type (sketch vs. photo) and orientation (inverted vs. upright) has not been studied for facial emotion recognition. Hence, we created a subset of emotional sketch faces (neutral, happy, fear, angry, sad expression) from the Radboud faces database [2], by extracting the most diagnostic facial features (e.g., eye, nose, and mouth).

Methods: N170 ERP component (P7 and P8 electrodes), were recorded among 25 participants (six female, 19 male), aged 20-40 years (M= 26.4± 6.5). ANOVAs were conducted with stimulus type (photo vs. sketch) and orientation (upright vs. inverted) as within-subjects factors.

Results: The behavioral results (unbiased hit rate and RTs) showed similar high-level performance when stimuli are upright, and a detrimental inversion effect, greater for sketch than photo faces. The N170 peak amplitudes showed typical inversion effect for photo but not for sketch faces. In contrast, upright sketch faces elicited greater responses than inverted sketch faces ($p < .008$). Finally, we found an additive effect of stimulus type (10ms increase for sketch faces) and stimulus orientation (7ms increase for inverted stimuli) on N170 peak latency.

Conclusions: Our brain is tuned to interpret photos displaying human faces. We have more neurons tuned to photo than sketch faces, although sketches may remind us of comics or cartoons. Along those lines, our results confirm that there is a processing advantage for recognizing emotion in photos. However, this recognition can be performed from sketch faces with the equivalent behavioral performance but increased brain activity, provided that diagnostic features are available. When stimuli are inverted, it impedes fast recognition and requires a different strategy based on facial configuration, and on some reorientation which increases processing load. Overall, the present study paves the way for emotion recognition remediation using neurofeedback with stimulus of variable complexity.

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Analysis of Spatiotemporal Dynamics of Handwriting for characterizing Alzheimer's Disease

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Résumé

Alzheimer is the most common neurodegenerative disease; however, as the onset of the disease is insidious, it is difficult to detect it in the early stages. Memory, language, general and fine psychomotor skills are progressively affected. Our aim is to characterize, on a graphical tablet, the handwriting of people affected by early-stage Alzheimer disease (ES-AD). To this end, we propose a novel approach consisting of a local analysis of spatiotemporal dynamics. As handwriting requires fine motor control, it has been studied as a biomarker of several pathologies. More precisely, the kinematics of handwriting, captured on a digitizing tablet, have been analyzed since they convey invisible but precious dynamic information on how handwriting is performed. Based on online handwriting (HW), several works have been carried out to characterize Parkinson, Alzheimer, emotion, to quantify the effects of drug therapy, and for studying the effect of age on handwriting.

A. Conventional Approaches on HW-based Alzheimer assessment

Most works on handwriting analysis are based on statistical tests. Few works, nonetheless, consider classification models. Both categories extract from the whole HW task (e.g. a series of continuous cursive 'l', a text or a sentence) global kinematic parameters like mean velocity, mean acceleration, mean pressure, in-air time, on-surface time.

Most, but not all, statistical test-based approaches (ANOVA, etc.) for AD assessment have shown significant difference between the classes (AD for Alzheimer Disease; HC for Healthy Controls; MCI for Mild Cognitive Impairment) w.r.t mean velocity. The mean pressure has shown significant difference for AD vs. HC and for HC vs. MCI, but none for AD vs. MCI. In-air-time, on-surface-time and task duration have also shown significant difference for discriminating the three groups, and also two pairs of them (HC vs. AD and HC vs. MCI). Overall, most of these works claim that patients with cognitive decline have slower velocity, lower pressure, and longer handwriting time.

In the classification mode, most approaches use a LDA or a logistic regression model taking as input features like mean pressure, in-air-time, on-surface-time, in-air-time/on-surface-time ratio, mean velocity and MMSE score. The reported classification rates range from 60% to much higher levels depending on the HW task and the classification case (MCI vs. AD, HC vs. MCI, MCI vs. AD, and altogether (HC, MCI, AD)).

Both categories of the approaches above consider global kinematic parameters (e.g. mean velocity) extracted from the whole HW task, which is a disadvantage since the dynamics of the parameters (e.g. velocity) are lost. These statistical tests are sometimes inconclusive or even contradictory. This may be explained by the relatively poor discriminative power of the global parameters, and the insufficient size of data which may lead to severe overfitting. Unlike most statistical methods, the classification ones take as input a set of parameters rather than one, each in turn. However, given the very small training datasets involved, the curse of dimensionality becomes severe, leading to a strong overfitting. The reported classification results are often misleading as they are obtained on the very data the models are trained on.

B. Our Approach

We propose a novel technique to characterize ES-AD w.r.t HC by analyzing the kinematics of online handwriting, on a task consisting of 4 series of cursive 4'l', written by each participant (Fig. 1). Instead of comparing ES-AD and HC based on global kinematic parameters, our approach addresses the limits of the studies above by performing such a comparison based on the full dynamics of these parameters. To do so, we first automatically segment the "4l" series into individual loops. To characterize the variability of loops over the two classes, we define a dictionary of prototype (representative) loops by a clustering scheme over the training data. The segmentation allows to significantly increase the size of the training data, and accordingly the reliability of the clustering. It also allows generating individual loop-based clusters, that are much more likely to be homogeneous than would be the clusters of entire series of 4l. Our clustering algorithm is based on the *K*-medoids algorithm, with a DTW (Dynamic Time Warping) dissimilarity measure that accommodates the sequential (time series) aspect of the loops. Each cluster thus generated consists of a set of loops pertaining to the two classes in different proportions, reflecting the cluster power in discriminating the two classes. To leverage all the loops generated by a given person in the test phase, we consider a Bayesian formalism that aggregates the contribution of each loop before making a classification decision over the two classes (ES-AD and HC). Our experimental results on a dataset acquired at Broca Hospital in Paris, from patients with ES-AD and from HC, show that the proposed approach yields a classification performance that significantly outperforms the state-of-the-art, using the Leave-one-person-out scheme, with a relative improvement of 50%.

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Stratégies pour la détection d'impact
Application à l'interaction homme-robot sûre

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Résumé

Avec le développement de robots manipulateurs légers et de stratégies de commande associées, la robotique collaborative suscite depuis plusieurs années un intérêt croissant dans le cadre de l'interaction homme-robot. Robot et opérateur évoluant dans le même espace de travail, la détection d'impact entre un bras robotique et son environnement est essentielle pour assurer la sécurité de l'opérateur d'une part, mais peut aussi permettre de réagir rapidement aux évènements extérieurs tels qu'un contact de l'opérateur dans l'intention de reconfigurer la tâche ou la trajectoire du robot. Ainsi, en cas de collision l'organe de pilotage du robot doit être en mesure de détecter celle-ci au plus tôt puis de réagir de manière appropriée selon la nature de l'impact : attendu dans le cadre de la tâche réalisée ou non-désiré et donc potentiellement dangereux. Par ailleurs, l'utilisation d'un nombre minimal de capteurs pour la détection, en particulier une dépendance moins grande aux capteurs d'effort voire leur absence, constitue un critère important en contexte industriel pour lequel intégration et coût sont deux contraintes fortes.

Dans ce contexte, les méthodes de détection courantes [1] nécessitent un modèle dynamique du système ce qui les rend sujettes au compromis entre sensibilité de détection et robustesse vis-à-vis des incertitudes de modélisation. L'approche proposée repose sur le développement d'une stratégie efficace pour la détection d'impact, robuste aux incertitudes de modélisation du robot et de son environnement et utilisant un nombre minimal de capteurs, notamment sans capteur d'effort. Dans un premier temps, une méthodologie quantitative pour l'analyse des algorithmes de détection d'impact est développée, tenant explicitement compte des erreurs induites par les incertitudes de modélisation et reposant sur une comparaison directe du modèle du robot avec les mesures [2] ou faisant appel à des observateurs [3,4]. Dans un second temps, une classification de l'impact selon sa nature est proposée en comparant les techniques de filtrage usuellement utilisées avec une approche par apprentissage supervisé et réseaux de neurones.

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Interpersonal Handshake study for Emotion Recognition in Social Robotics

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Summary

Handshake manner is one of the most common social tactile behavior, used in a large range of countries, contexts, and acquaintances. Implementing this skill in social robots is a challenging task but has received researchers' motivation for years. A lot of studies about human-robot handshake exist, improving the movement [1], the synchrony [2], often transferring human behavior to robots, or conducting Turing tests to evaluate the move realism [3]. There is work about hand anthropomorphism to improve grip comfort [4]. However, few studies characterize the meaning of the observed variation in handshake manner. A social robot should not only be able to copy human manner, or be mechanically compliant, it should also decode the message communicated during handshake, and be able to express its own artificial psychological profile. The goal of our research is to read the internal profile of a subject while performing handshake greeting. Some qualitative studies exist in psychology about gender and personality [5]. Previous work found consistent results about gender and extraversion during interpersonal handshakes [6]. In this contribution, we are interested in emotion recognition. We first present a system able to measure pressure and movement during interpersonal handshake, and an experimental protocol using an emotion elicitation tool. We then present results about the collected pressure data, depending on emotional conditions.

We designed two gloves with 23 soft piezo-resistive pressure sensors each, an accelerometer, and a gyrometer. The experimental setup, used to study the effect of emotion on handshake manner, involved an emotion elicitation tool exploiting the virtual reality (VR) media [7]. 14 participants were able to perform handshakes with a virtual agent and the experimenter, before and after viewing emotional content in VR. They tested 3 emotional conditions upon the 4 available (Fear, Sadness, Joy and Neutral), and evaluated the emotion felt.

We analyzed the pressure data on databases of the non-emotional handshakes and of a preliminary experiment in which both partners had specific handshakes firmness instructions. We were able to understand the contribution of each sensor in the handshake manner (see Figure 1). We also observed a high variability on pressure depending on participants. It can be spatial or in term of magnitude. Finally, after projecting the pressure of the sensors activated by the participants on both hand in a PCA space, no significant difference depending on emotion could be found. This questions both the real emotional state during the handshake act, and the ability of emotion to be transmitted through handshake.

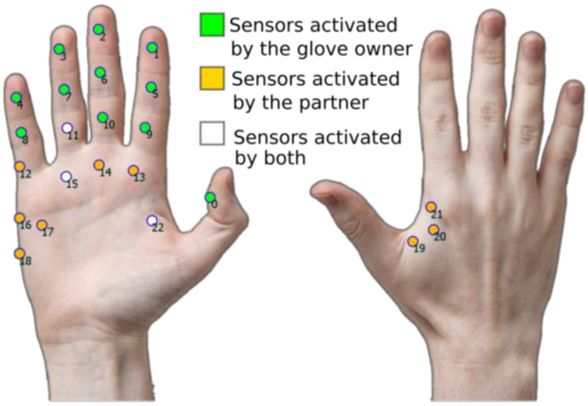

Figure 1 : Position of the sensors activated by the glove owner or its partner

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