PROJECT OF SCIENCE AND TECHNOLOGY CO-OPERATION

BETWEEN

MIDDLESEX UNIVERSITY
SCHOOL of COMPUTING SCIENCE
UNITED KINGDOM

AND

ROSTOV STATE UNIVERSITY (RSU)
A.B.KOGAN RESEARCH INSTITUTE FOR NEUROCYBERNETICS (KRINC)
LABORATORY OF NEUROINFORMATICS OF SENSORY AND MOTOR SYSTEMS (LNISMS)

RUSSIA

INVARIANT IMAGE RECOGNITION BY IDENTIFICATION OF THEIR MOST INFORMATIVE REGIONS

2004-2006

LONDON – ROSTOV-ON-DON

1 - Title of the project:

INVARIANT IMAGE RECOGNITION BY IDENTIFICATION OF THEIR MOST INFORMATIVE REGIONS

2 - Partners:

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Project Director: Head of the LNISMS, Dr. Lubov Podladchikova, PhD

3 - Goal of the Project:

The main goal of the Project is an application of the approaches and methods developed earlier [Gao X. et al, 2002-2003; Shaposhnikov D.G et al, 2002-2003] for invariant recognition of traffic sign, face, and lesions on medical images, particularly, PET images. The specificity of our approach for image processing and recognition consists of: (i) colour segmentation by CIECAM97 model [Gao X. et al, 2002], (ii) identification of the most informative image regions, (iii) space-variant or fovea-like representation, (iv) content feature description.

4 - Expected results:

Software module of the systems for processing and invariant recognition of traffic signs and faces (as DLL module or as the separate system). Expected performance of the system are as follows: recognition rate in some range of transformations (rotation variations - about ±30 degrees in horizontal plane and ±15 degrees in vertical ones, size change - ±50%, brightness fluctuations - ±30%) - not lower than 98% (for traffic signs) and 95% (for faces); recognition time (without special boards for image processing) - up to 1s per image for large database. Algorithms and methods for identification of the most informative lesioned PET images regions will be attempted (if special financial support will be received). Joint publications on the theoretical and experimental results.

5 - Objectives:

1. Design of the software module based on the model for invariant traffic sign images recognition developed earlier.
2. Verification of the model prediction about possible errors in the human perception of warning traffic signs in psychophysical experiments.
3. Development of an algorithms for face detection based on colour segmentation by CIECAM'97 model and by determination of the common contour of the most informative image regions.

4. Development of an algorithms for detection of stable regions in the facial images.
5. Development of an algorithm for identification of the most informative regions in PET images.

6 - Preliminary joint work:

This Project is continued of the joint Project "Development of Biologically Plausible Models of Vision with Application to Real-world Image Analysis" (2001-2003). The collaborative work started in 2000 during 4-th International Conference on Cognitive and Neural Systems (Boston, USA). In 2001, by the support of The Royal Society under international exchange scheme (gt/Ex-Agr/hostacct), a Russian team member, Dr. Shevtsova visited the Middlesex University for 6 weeks to apply the Behaviour Model of Vision (BMV) to the traffic sign recognition task. The obtained results were published in 9 papers and presented on 6 of international conferences.
The work was based on application of two models developed earlier for image segmentation and recognition. The first of them is the CIECAM97 model [Gao X. et al, 2002] and the second one is the BMV model [Podladchikova L.N. et al, 1997; Rybak I.A et al, 1998]. The main goal of this work was a creation of a low-cost and high-performance traffic sign recognition system based on bio-vision simulations. Several new algorithms and procedures to improve the system recognition rate and computational efficiency were elaborated.
The results obtained during previous Project implementation indicate on possible ways for modification of the developed system to improve the recognition efficiency. In particular, an approach to achieve a stable recognition rate by the BMV model for partially occluded traffic signs should be found. Further more, an opportunity for application of face recognition methods and algorithms to improve the analyses the PET images will be investigated.

7 - Steps of the Project and the role to be played by each research team:

The whole work will be carried out using mathematical modelling and computer simulation methods. The steps of work are coincident with Objectives of the Project. Basic model for traffic sign segmentation and recognition developed earlier [Gao X. et al, 2002-2003, Shaposhnikov D.G. et al, 2002-2003] will be used during the Project implementation.

KRINC, Rostov State University (RUSSIA):
Stage 1. Design of the software module based on the model for invariant traffic sign images recognition developed earlier. Development of assistant tools to carry out extensive computer simulation and to estimate the system performance.
Stage 2. Development experimental set up and conducting psychophysical experiments for verification of the model prediction about possible errors in the human perception of warning traffic signs.
Stage 3. Development of an algorithms for detection of stable regions in the facial and PET images.
School of Computing Science, Middlesex University (UNITED KINGDOM):
Stage 1. Creation of a database of real world traffic signs arranged according to their transformations based on own algorithms of colour segmentation.
Stage 2. Development of software for segmentation of traffic sign by CIECAM'97 model.
Stage 3. Development of an algorithms for face detection based on colour segmentation by CIECAM'97 model.

8 - Organization and Financial Statement:

In the framework of the present Project, each partner has its own financial support of research. Additional financial support may be search from different national and international foundations. The additional cause will be negotiated and signed respectively by both Institutions.

9 - Exchange of research teams:

The partners will exchange scientific reports, papers and demonstration data. They will prepare joint publications and exchange scientists for participation in scientific and educational seminars and carrying out joint research works.

10 - Research team list:

From the KRINC:

Project Director:	L.PODLADCHIKOVA	Head of the LNISMS
Principal Investigators:	A.GOLOVAN	Senior Researcher
	V.GUSAKOVA	Senior Researcher
	D.SHAPOSHNIKOV	Researcher
	N.SHEVTSOVA	Senior Researcher

From the School of Computing Science:

Project Director:	X. GAO	Senior Lecturer
Principal Investigators:	K.HONG	PhD Student
	S.BATTY	PhD Student

11 - Duration of the Project:

This agreement comes into force upon signing and will remain continue in force for a three year period, 2004-2006 renewable by explicit agreement. This agreement can be cancelled by either of the two partners with a six months advance notice.

12 - Administrators of the project:

Signed, from the **Middlesex University**:	Signed, from the **Rostov State University**:
Vice-Chancellor/Dean of School, Professor Norman Revell	Director of the KRINC, Professor Boris Vladimirsky
Project Director, Dr. X. Gao	Project Director, Dr. L. Podladchikova
Date:	Date: