



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

**DEVELOPMENT OF BIOLOGICALLY PLAUSIBLE MODELS OF VISION
WITH APPLICATION TO REAL WORLD IMAGE ANALYSIS**

2001-2003

LONDON – ROSTOV-ON-DON

1 - Title of the project:

DEVELOPMENT OF BIOLOGICALLY PLAUSIBLE MODELS OF VISION
WITH APPLICATION TO REAL WORLD IMAGE ANALYSIS

2 - Partners:

Middlesex University:

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Project Director: Senior Lecturer Dr. Xiaohong Gao

Rostov State University:

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Project Director: Head of the LNISMS Dr. Lubov Podladchikova

3 - Goal of the Project:

The long-term goal of this research is to find ways for the development and implementation of a biologically plausible models of visual system and for their applications of high-performance on colour segmentation, analysis, and recognition of some objects in real world images. As one of the Project tasks for real world image processing, the traffic sign recognition problem has been determined. Other tasks may be formulated during the Project implementation.

4 - Expected results:

Algorithms and software implementation of models of visual system and estimations of their performance while processing and recognition of real world images; the results of psychophysics experiments about peculiarities of the human visual perception of objects under study (in particular, traffic signs).

Joint publications on the theoretical and experimental results. Application for patent when the system is ready.

5 - Objectives:

The first objective is modification of the model of colour segmentation and the Behavioral Model of Vision (BMV) developed earlier to improve their accuracy and to increase the processing speed. The originality of the models lies in the use of biologically plausible algorithms and methods at low- and high-level image processing.

The second objective is carrying out psychophysics experiments for searching for the most informative regions of objects under study (in particular, traffic signs) for determining the number of fixations that is necessary for adequate representation of an object by the BMV model.

The third objective is integration of the developed advanced models (i.e., the colour segmentation and the BMV) into task-oriented processing system.

6 - Preliminary joint work:

Since 2000 we are involved in a joint research within the frameworks of the initiative collaboration and Exchange Visit Grant received from the Royal Society. This work resulted in testing the BMV developed earlier in the LNISMS of the KRINC, RSU, to the traffic sign recognition problem. It is found that the general model demonstrates more than 88% recognition rate for this specific task for real world images under various weather conditions. Two databases of traffic sign images were developed and tested.. Computer experiments for recognition of real world traffic sign images have shown: (i) preliminary separation of traffic sign images by colour and form can improve the model performance; (ii) importance of Attention Window fixation points chosen while viewing trajectory formation; (iii) the template image encoding indicates the necessity of psychophysics experiments to better understand what attracts visual attention while viewing traffic signs of various complexity in real world conditions and to find the most informative regions in traffic sign images. The results obtained are presented in 3 conference papers in preparation and in International Exchange Grant Report to the Royal Society.

The present proposal is aimed to make a further progress in our joint research.

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. Two basic models will be used during the Project implementation, namely, the model of colour appearance for segmentation and the BMV, developed earlier in the School of Computing Science and in the KRINC, correspondingly.

KRINC, Rostov State University (RUSSIA):

Step 1, 2001 - to develop advanced task-oriented modifications of the BMV and to test them while processing real world images;

Step 2, 2002 - to carry out psychophysics experiments for optimization of the BMV parameters;

Step 3, 2003 - to integrate the most effectively developed algorithms and methods for grey-level image processing into the BMV and to implement high-performance task-oriented processing system for real world image processing.

School of Computing Science, Middlesex University (UNITED KINGDOM):

Step 1, 2001 - to create a database of real world British traffic signs arranged according to their transformations based on own algorithms of colour segmentation;

Step 2, 2002 - to optimize algorithms and model of colour appearance based on the results of psychophysics experiments and the BMV testing;

Step 3, 2003 - to integrate the most effective developed algorithms and methods for colour image processing into the colour segmentation model and to implement high-performance task-oriented processing system for real world image processing.

8 - Organization and Finance Statement:

In the framework of the present Project, each partner has its own financial support of research. Besides, additional financial support may be received from different national and international foundations.

An additional clause may anticipate the detailed organization of the exchanges as far as scientific and financial aspects are concerned. The additional clause 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 V.GUSAKOVA D.SHAPOSHNIKOV N.SHEVTSOVA	Senior Researcher Senior Researcher PhD Student Senior Researcher

From the School of Computing Science:

Project Director:	X. GAO	Senior Lecturer
Principal Investigators:	K.HONG S.BATTY	PhD Student 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, 2001-2003, 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: