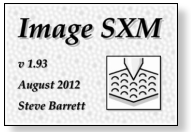
Microscopy Image Analysis Software for Medical Applications

MIASMA

Microscopy Image Analysis Software for Medical Applications

So what can a physicist do to make an impact on global health?

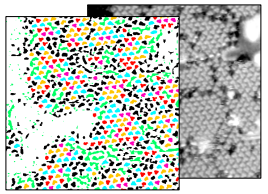
Background in nanoscale physics



Expertise in image analysis of scanning microscopy images (STM, AFM, SEM)

Recognising molecular shapes
(adsorption geometry)

Identifying molecular positions
(substrate registration)



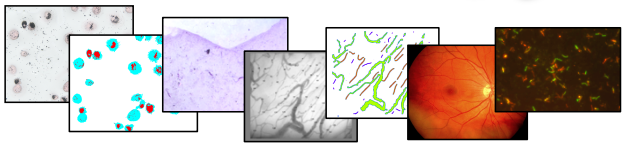
Microscopy Image Analysis Software for Medical Applications

Liverpool Medical Imaging Network (LMI-Net) workshops

Put me in touch with medics who had image analysis problems

Some researchers within UoL, some clinicians in hospitals

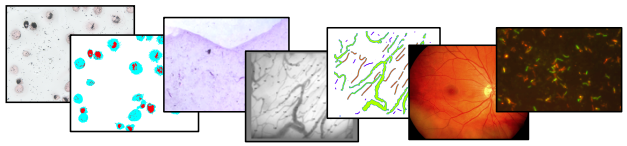
Resulted in a number of collaborations MIASMA



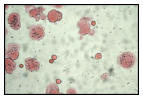
Microscopy Image Analysis Software for Medical Applications

Projects include…

Carbon particulate matter in lung cells (lung cancer)
Parasite analysis (malaria)
Blood flow velocities in capillary networks (meningitis)
Retinal image analysis (diabetes)
Parasite morphology and development (leishmania)
Assessing antibiotic treatments (tuberculosis)



Intracellular Air Pollution Particulates



Collaborators

Dr Stephen Gordon
Liverpool School of Tropical Medicine

Dr Duncan Fullerton
Liverpool School of Tropical Medicine

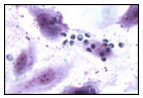
Aims

i) To identify particulate matter and differentiate it from cell cytoplasm.

ii) To measure the area of particulate matter relative to that of the cell cytoplasm.

Documentation MIASMA-PMA-v7.pdf

Malaria Parasites



Collaborator

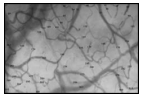
Professor Alister Craig
Liverpool School of Tropical Medicine

Aim

To identify malaria parasites and differentiate them from background features.

Documentation MIASMA-PCA-v5.pdf

Microcirculation Flow



Collaborators

Dr Enitan Carrol
Institute of Child Health, UoL

Dr Richard Sarginson
Alder Hey Children's Hospital

Dr Fauzia Paize
UoL and Liverpool Women's Hospital

Aims

i) To identify capillaries in videos of capillary networks and measure capillary vessel density.

ii) To measure blood flow speed as a function of capillary diameter.

Documentation MIASMA-MCA-v5.pdf

Retinal Imaging

Collaborators

Professor Simon Harding
Ophthalmology Research Unit, UoL

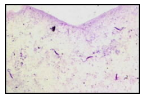
Dr Yalin Zheng
Ophthalmology Research Unit, UoL

Aims

To identify specific features such as:
- Blood vessel network
- Optic disc
- Haemorrhages
- Exudates

Documentation Not yet available

Parasite Morphology



Collaborators

Dr Rod Dillon
Liverpool School of Tropical Medicine

Mr Hector Diaz
Liverpool School of Tropical Medicine

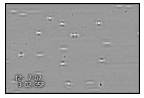
Aims

i) To identify leishmaniasis parasites.

ii) To identify the developmental stage of the parasites by the shape and size of the parasite bodies and flagella.

Documentation Not yet available

Lymphocyte Flow



Collaborator

Dr Carlo Laudanna
Department of Pathology
University of Verona

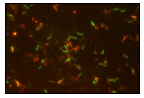
Aims

i) To identify lymphocyte cells flowing through a glass capillary.

ii) To measure the length of time that cells are arrested by or rolling along the capillary wall.

Documentation MIASMA-LFA-v4.pdf

Bacilli Lipid Bodies



Collaborator

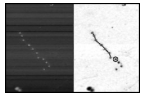
Dr Derek Sloan
Clinical Sciences, UoL

Aim

To measure the number of bacilli that contain lipid bodies.

Documentation Not yet available

Fibrillin Microfibrils



Collaborator

Dr Riaz Akhtar
Ocular Biomechanics Group
School of Engineering, UoL

Aim

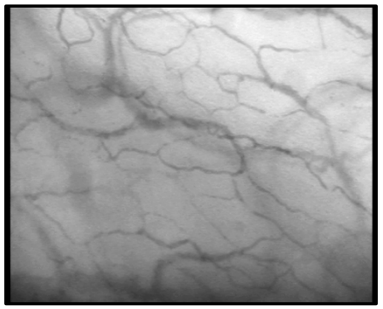
To speed up the analysis of microfibrils by semi-automating the process of identifying microfibril beads and calculating their xy coordinates.

Documentation MIASMA-MFA-v2.pdf

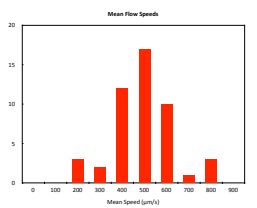
Microscopy Image Analysis Software for Medical Applications

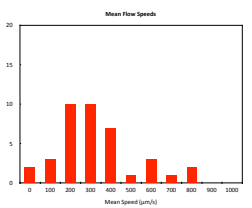
Take one MIASMA project as an example…

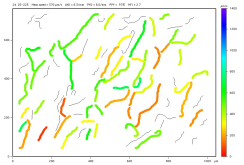
Blood flow velocities in capillary networks (meningitis)

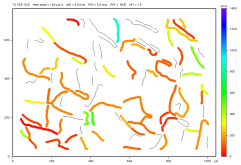


Microscopy Image Analysis Software for Medical Applications

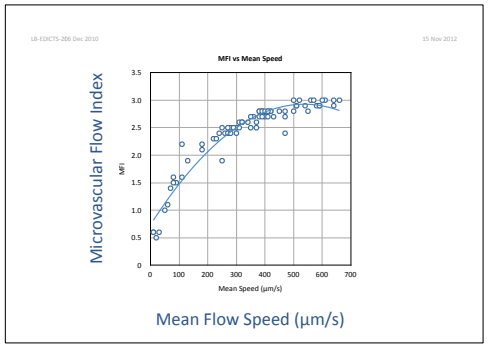








Microscopy Image Analysis Software for Medical Applications



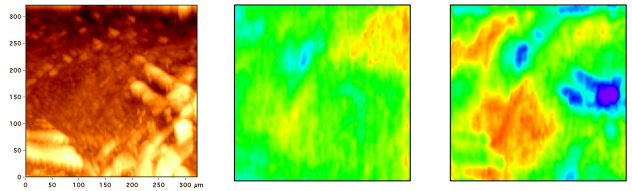
Mean Flow Speed (μm/s)

Microscopy Image Analysis Software for Medical Applications

The latest MIASMA project…

Imaging of biopsies with THz radiation (cancer)

Is there a pre-cancer signature in the infrared absorption?



Topography **IR λ = 7.3 μm** **IR λ = 8.6 μm**

Microscopy Image Analysis Software for Medical Applications

MIASMA

http://www.liv.ac.uk/~sdb/MIASMA