Method for Identifying Fluid and Substrate Chemistry Based on Automatic Pattern Recognition of Stains

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Technology description

Invention

The invention is an identification method where images of stains from nL drops are automatically identified as signatures of fluid composition and substrate chemistry, for e.g. rapid biological testing. Supervised pattern recognition algorithms are used to identify an unknown stain by measuring its similarity to representative examples of predefined categories. The accuracy ranges from 80 to 94%, compared to an accuracy by random assignment of 3 to 4%. Existing unsupervised pattern recognition algorithms are also applied to group stain images into a number of ensembles each likely to correspond to similar combinations of fluids and substrates. The clustering accuracy ranges from 62 to 80%, compared to accuracy by random assignment of 3 or 4%. The algorithms were remarkably accurate at determining the presence or absence of biotin and streptavidin respectively in the liquid and on the glass, the salt composition, or the pH of the solution.

Background

Rapid characterization and accurate disease diagnosis from biological fluids such as blood, pleural effusions, joint fluid or cerebral spinal fluid (CSF)) remains a major clinical challenge in patients with cancer, hematological, endocrine, infectious, rheumatologic, neurological and cardiac diseases. These diseases are major health risks for which a comprehensive rheological profile of effusions or blood would consequently have the greatest impact in diagnosing and treatment that might ultimately lead to a reduction in the national prevalence and mortality of such diseases. Direct measurement of biomarkers, rheological properties, and optical properties of the fluid stains would be highly desirable because it could provide a reliable tool for estimating therapeutic response and rapid diagnostic analysis, such as being able to distinguish between non-malignant and malignant effusions.

Application area

Clinical diagnostics, such as the classification of pleural effusions and has the potential to enable rapid screening at the point-of-care.

Quickly determine protein content of clinical samples such as pleural effusions or cerebrospinal fluid for early diagnosis Investigate specific interactions between the fluid and biomarkers patterned on the surface.

Advantages

Potential for rapid and direct detection of the content of small volume of fluids evaporating onto a substrate.
Provides unique information through optical imaging and data processing of complex patterns of an analyte drop when evaporating.
Provides clinicians with a rapid easy-to-use tool to assist them with diagnosing viscosity-related disorders
It can replace lengthy and costly battery of biochemical assays currently used in early diagnosis of tumor or cardiovascular diseases biomarkers.

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