FROM IMAGE TO ACTION

ANALYZE
IDENTIFY
COUNT
VIABILITY
BACKGROUND

BEACHHEAD MARKET
BIOPROCESSING

TOTAL MARKET: 1.1 B€
GROWTH RATE: 6%

SUSPENSION UNITS
ADHERENT UNITS

DIAGNOSTICS UPSIDE

PAP SMEARS IN UNITS

TOTAL MARKET: 3.46B€
TOTAL # OF TESTS: 200 M
COST PER SMEAR: 18 – 30€
GROWTH RATE: 4%

PEOPLE AND ECOSYSTEM

16 OVIZIO
RESEARCH ECOSYSTEM

FUNDING

15.211 K€
4.700 K€

PARTNERS

APPLIKON
PALL LIFE SCIENCES

OTHER

FOUNDED IN DEC 2009
SPIN-OFF ULB
ISO 13485 IN PROGRESS

PATENTS

ULB GRANTED
OVIZIO FILED
OVIZIO GRANTED

1
7
6

STRICTLY CONFIDENTIAL
DDHM technology

1. Viable Cell Counting Principle
2. Differential Digital Holographic Microscopy
3. Results

Patented viability method
Invented by prof. Frank Dubois ULB (patent US 7,362,449 & ep1631788)

Strictly Confidential
HOW DO WE ANALYZE IMAGES

- Acquire hologram
- Compute phase
- Detect light cones
- Refocus all objects
- Extract fingerprint

Strictly Confidential
HOLOGRAPHIC FINGERPRINT FOR CELLS

PARAMETERS
SYSTEM
MORPHOLOGY
OPTICAL
PHASE TEXTURE
INTENSITY TEXTURE

- NUCLEUS TO CYTOPLASM RATIO
- VOLUME
- DIAMETER
- LENS BEHAVIOR
- CELL PERIMETER
- CIRCULARITY
- MEMBRANE INTEGRITY
- HEIGHT VARIANCE
- SIZE

74 PARAMETERS ARE RECORDED PER CELL – MACHINE LEARNING

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- IDENTIFY
- DIFFERENTIATE
- COUNT
- COMPARE
- ANALYZE
- ASSESS VIABILITY
## MACHINE LEARNING METHODOLOGY

### STEP 1
**LEARNING SET CREATION**

- **100% LIVING CELL**
- **100% DEAD CELLS**

### STEP 2
**SYSTEM TRAINING**

- FEED SYSTEM WITH KNOWN MIXTURES
- FROM 100% TO 0% IN STEPS OF 10

### STEP 3
**PREDICTION**

- Single cell analysis
- Real-time measurements
- Cell culture parameters

- **Cell Viability:** 81.6%
- **Aggregate Rate:** 14.6%

- **Viable Cell Density:** $2,76 \times 10^6 \text{ cells/ml}$
BENEFITS OF AUTOMATION

- INCREASED CONTROL
- TIME GAIN AND TRACEABILITY OF RESULTS
- INCREASED REPRODUCIBILITY
- DRASTIC REDUCTION OF MANUAL OPERATIONS
- REDUCED INVESTMENT AND FTE COST – FAST ROI
OSONE: CELL VIABILITY INDICATORS

Viability: 95.8%
Minimum: 90.6%
Maximum: 100.0%
Viable Cell Density: $4.36 \times 10^6$ cells/ml
Minimum: $3.79 \times 10^6$ cells/ml
Maximum: $4.87 \times 10^6$ cells/ml

Diameter: 15.14
Minimum: 11.21
Maximum: 24.28
Standard Deviation: 1.60

Total Cell Density: $4.35 \times 10^6$ cells/ml
Total cell count: 1,188 cells in 25 images
Viable cells: 1,390 cells
Dead cells: 58 cells
Rejected events: 807 events
Aggregate Rate: 0.7%
CONTINUOUS MONITORING

STATISTICAL RELEVANCE
ILINE F: 6000 IMAGES PER DAY
CELL COUNTER: 50-100 IMAGES PER SAMPLE
NO DILLUTION REQUIRED
OPC Integration

PC
- Physically close to device
- Performs data acquisition
- Receives (OPC, Web Service) commands from customer SCADA
- Transfers results and images to SCADA system and/or customer storage space
- OSoOne remotely accessible via VNC or Remote Desktop

OPC integration

Remote PC
Allows full control of OSoOne remotely via web interfaces and web services calls

View client

Network

Physical connection to device

BUSINESS LOGIC
PLUGINS
API.NET
C++ CLI
C++

OS ONE
API
FACE
WEB SERVICES
OS Ø

KEPLER OPC SERVER
Web service Plugin

CUSTOMER SCADA SYSTEM

Ovizio

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TECHNOLOGY COMPARED

R = 0.968
VARIABILITY-TCD

TCD - COMPARISON

\[ y = 0.9771x \]
\[ R^2 = 0.99007 \]

TCD - BioConnect 2 (10E+6 cells/ml) vs TCD - BioConnect 1 (10E+6 cells/ml)

VIABILITY COMPARISON

\[ y = 1.0147x \]
\[ R^2 = 0.98705 \]

Viability - BioConnect 2 (%) vs Viability - BioConnect 1 (%)

VCD COMPARISON

\[ y = 0.9933x \]
\[ R^2 = 0.99651 \]

VCD - BioConnect 2 (10E+6 cells/ml) vs VCD - BioConnect 1 (10E+6 cells/ml)

IN SAMPLE

Graph showing viability and cell density over time.
CASE STUDY: VIRAL LOAD MEASUREMENT

- INFECTED CELL
- PROTEIN EXPRESSION
- NON-INFECTED CELL
CASE STUDY – DISCRIMINATE CELL TYPES

BACKGROUND
- US CUSTOMER
- IMMUNOTHERAPY
- ENHANCED DENDRITIC CELLS
- 6 – DAY PROCESS

CHALLENGES
- IN-PROCESS COUNTING OF VIABLE CELL DENSITY OF:
  - RED BLOOD CELLS
  - GRANULOCYTES
  - LYMPHOCYTES
  - DENDRITIC CELLS
- NO LOSS OF SAMPLE VOLUME

CRITICAL PARAMETERS HERE ARE TO MONITOR CELL CHARACTERISTICS
CASE STUDY – RESULTS COUNT

0.79 M Cells/ml

6.5 M Cells/ml

Monocytes  Lymphocytes  Granulocytes

Monocytes  Lymphocytes  Granulocytes
MULTI LAYER RECIPIENTS
MSC CELLS – XP10

MULTIPLATE OBSERVATION

Plate 1

Plate 3

Plate 6

Plate 8

XP10_Day5_plate 1

XP10_Day5_plate 3

XP10_Day5_plate 6

XP10_Day5_plate 8
CLIENT TEST: AUTOMATED CONFLUENCY

20130205 Client MSC Stem Cells – 70%

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CLIENT TEST: AUTOMATED CONFLUENCY

20130205 Client MSC Stem Cells – 90%
OVIZIO VS MANUAL MEASUREMENT

CONFLUENCE MEASUREMENTS MATCH THE ESTIMATIONS OF A HUMAN OPERATOR CLOSELY. CONFLUENCE IS THE PARAMETER OF MAIN IMPORTANCE AT THIS STAGE.

\[ y = 0.8417x + 9.9266 \]

\[ R^2 = 0.89186 \]
THANK YOU FOR YOUR ATTENTION!

We would love to continue the discussion with you…

IF YOU WANT TO TRY OUR SYSTEMS SEND MAIL TO:
info@ovizio.com