TruScreen

Reproducibility of Test Result & Test-Retest Reproducibility

11 November, 2024

About **TruScreen Technology**

TruScreen

Handheld device

Single Use Sensor (SUS)

Intelligent Cradle

Primary cervical cancer screening device for detection of pre-cancerous and cancerous cervical tissue via an AI generated Algorithm

What is the TRU System and how does it work? The TRU system consists of a handheld device (HHD), intelligent cradle and a single-use-sensor (SUS).

TruScreen Regulatory Approvals

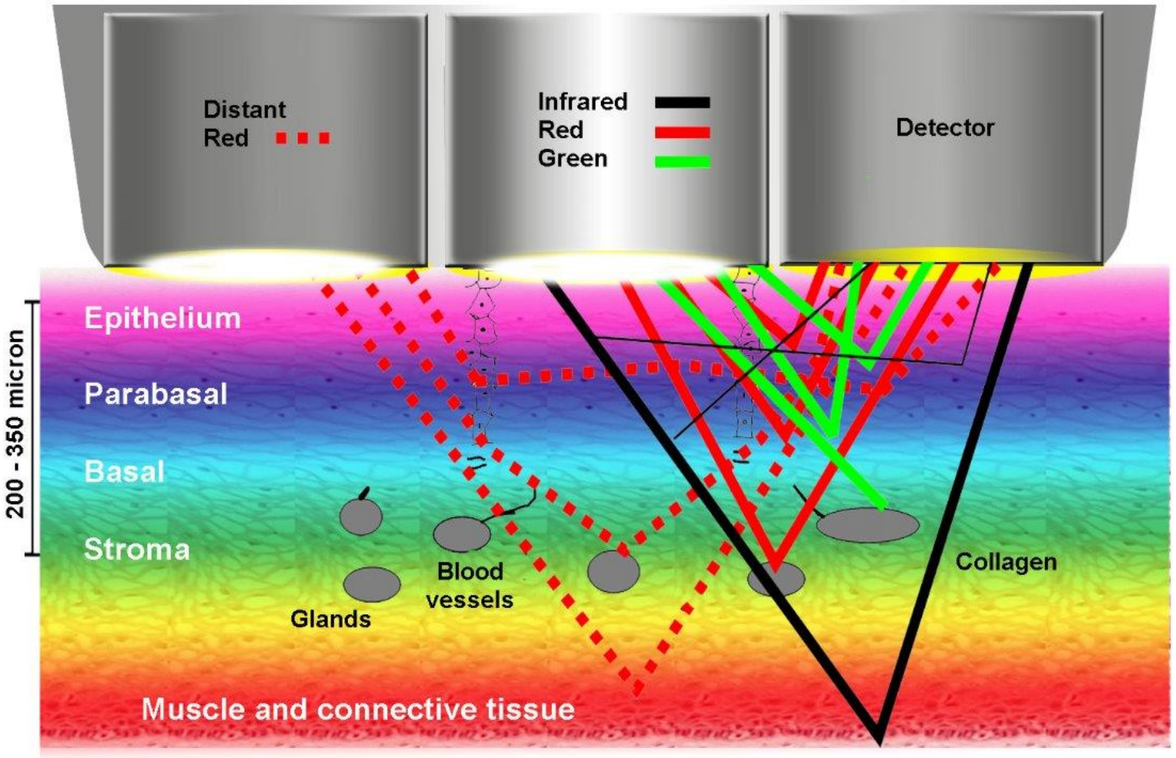
International Quality Accreditation:

- ISO 13485
- ISO 60601-1-2
- CE Mark

International Approvals:

- CE Mark, European Union
- NMPA, China
- TGA, Australia
- MHRA, UK
- SFDA, Saudi Arabia
- Roszdravnadzor, Russia
- COFEPRIS, Mexico
- WAND New Zealand
- Zimbabwe Ministry of Health
- IEAKI Indonesia
- Vietnam Ministry of Health

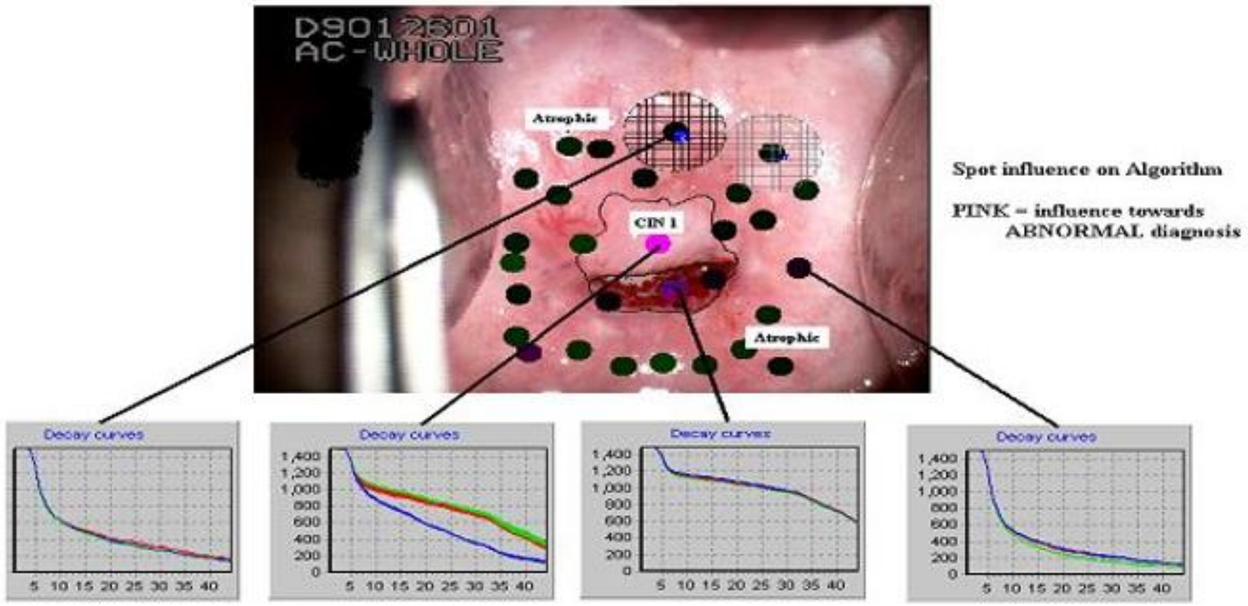
Optical Tissue Differentiation



TruScreen measures the scattering and diffuse reflection of Distant Red, Red, Infrared and Green light.

TruScreen detects changes in sub-surface tissue that are not visible in visual inspection or collected in a Pap Smear sample.

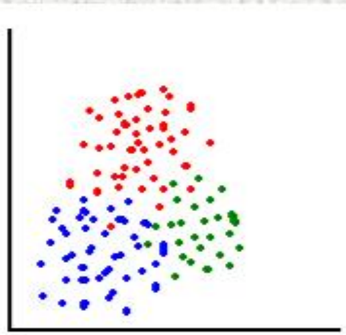
Electrical Tissue Differentiation



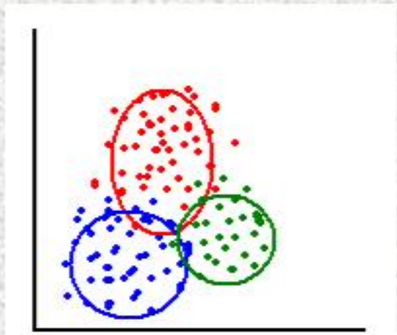
Squamous tissue acts as a battery and stores, for a brief period, electrical charge.

TruScreen stimulates the cervix with low voltage multi pulse stimulation (0.78 V) and then measures the voltage decay of the tissue.

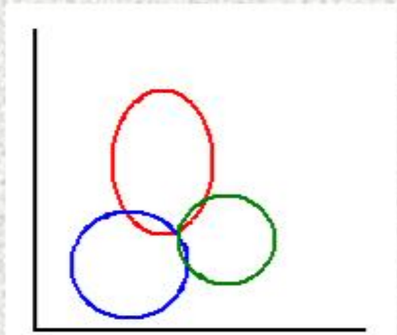
Algorithm and a Repeatable Result



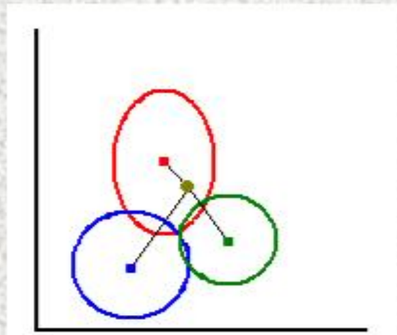
Data
Raw data is converted into features. In unsupervised clustering the data is not labelled.



Training
The training algorithms identify clusters in the data.



Model
The description (parameters) of each cluster is used as the model of the data.



Execution
New data is classified by its relative membership in each cluster, e.g. 70%, 10%, 20% (anti-clockwise from top).

TruScreen Algorithm

Developed by PLT/CSIRO / University of Sydney

- The Algorithm Team were led by Geoff Mckellar and Stephen Gould at PLT and David McMichael at the CSIRO, and a PLT team led by Victor Skladnev developed the ‘probe’ and signal processing technology.

- Algorithm development utilised mathematical techniques including PCA, mixture models, clustering/vector quantization, SVM, neural network, logistic classifiers.

- Mixture models and logistic classifier gave the best performance

TruScreen Algorithm

- The Algorithm D2.03G was then ‘frozen’ and provided that the TruScreen Device is in ‘spec’ and the users follow the IFU then a reproducible/repeatable result is assured

- This has been clinically verified in trials involving more than 40,000 women, in multiple settings and across multiple ethnicities

Improvements using
  - Feature engineering (e.g. add Fourier transform based features)
  - Support Vector Machine
  - Random Forest
  - Sparse expectation–maximization (EM) algorithm
  - Monte Carlo method

Showed no improvement on the TEST database, even though they showed improvement on the development database.

Reproducibility of TRU Result

The TruScreen Algorithm is fixed and processes data using the same 'cluster' definitions for every patient:

But**:**

<u>Equipment and People vary</u> thus the control of the quality of input date is essential:

Equipment Variability to be stabilised:

- Handpiece parameters
- SUS Parameters
- Ageing effect on both
- Start UP Self Check – Electrical and Optical
- OTP Test
- SUS Fit test – Electrical
- SCS at 20 Tests (Gain/Drive Current)
- Probing Pattern

Human Variability to be stabilised

- Follow the IFU
  - Contraindications
  - Patient Preparation
  - Probing Pattern
- TRAINING

CREATE a DEVICE AGNOSTIC SOLUTION

Reproducible Results Require Reproducible Equipment and Reproducible Users

Reproducibility of an Algorithm

The use of AI to enable an algorithm to 'self-improve' raises many questions.

- If an Algorithm is constantly 'improving' how is it clinically verified and validated.
- If the Algorithm is 'improved' via input data, how is the input equipment controlled so that the input data is constant, and not compromised by variable background 'noise'
- Light Source, cameras etc. As these age and the intensity and colour of the background light changes, how does the equipment compensate for these variations?

Self Learning Algorithms are meant to be Self Improving

BUT

If Poor Data enters the learning process will the Algorithm learn 'bad habits'

And

Become less accurate rather than more accurate.

Reproducibility of an Algorithm

- As cameras change, how does the algorithm compensate or adjust to the differing optics of the new camera?
- Solarscan lessons….perfect colour and prefect light for melanoma screening
- If the Algorithm is ‘improved’ via input data, how is the human element controlled so that the input data is constant, and not compromised -
  - User training and technician training

What is a Gold Standard

If the AI inputs are measured against a database of classifications derived from ‘Gold Standard’ diagnoses, how Gold is that Standard?

Subjective analyses of images, laboratory handling failures, poor sample collection and processing can all devalue the Gold in any standard.

What is a Gold Standard

- Colposcopy
- Histology
- HPV DNA
- All have human input…..
- Lessons from around the world show that a ‘suspicious’ mind will guard against blind trust

Thus Reproducible Results Require not just Reproducible Equipment and Reproducible Users, **but an unvarying Gold Standard**