



Shared IT Services for Higher Education & Research

Conference 2017



Using Machine Learning to Verify the Identity of Distance-Learning Students

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Invented and developed by Douglas Engelbart, with the assistance of Bill English, during the 1960's and was patented on November 17, 1970.

<http://www.computerhistory.org/collections/catalog/102635897>

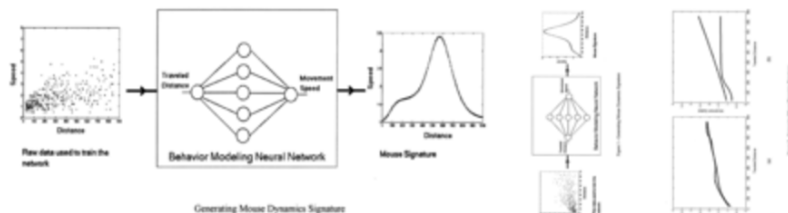
Intrusion detector based on mouse dynamics analysis

US 20040221171 A1

ABSTRACT

A biometric intrusion detection system based on mouse dynamics analysis, the analysis of mouse dynamics for a specific user generates a number of factors (Mouse Dynamics Signature) which can be used to ensure the identity of the user, an intelligent detection technique is developed to recognize differences in behaviors and detect intrusion.

IMAGES (3)



Publication number	US20040221171 A1
Publication type	Application
Application number	US 10/427,810
Publication date	Nov 4, 2004
Filing date	May 2, 2003
Priority date 	May 2, 2003
Also published as	CA2535542A1 , CA2535542C , US8230232 , US20060224898 , WO2004097601A1
Inventors	Ahmed Awad Ahmed , Issa Traore
Original Assignee	Ahmed Ahmed Awad E. , Issa Traore
Export Citation	BiBTeX , EndNote , RefMan
Patent Citations (1), Referenced by (22), Classifications (6)	
External Links:	USPTO , USPTO Assignment , Espacenet

Machine Learning

My Research Projects

1. Using Machine Learning to Predict Response Time on Stack Overflow



Stack Overflow is the largest online community for programmers to learn, share their knowledge, and advance their careers.

My Research Projects

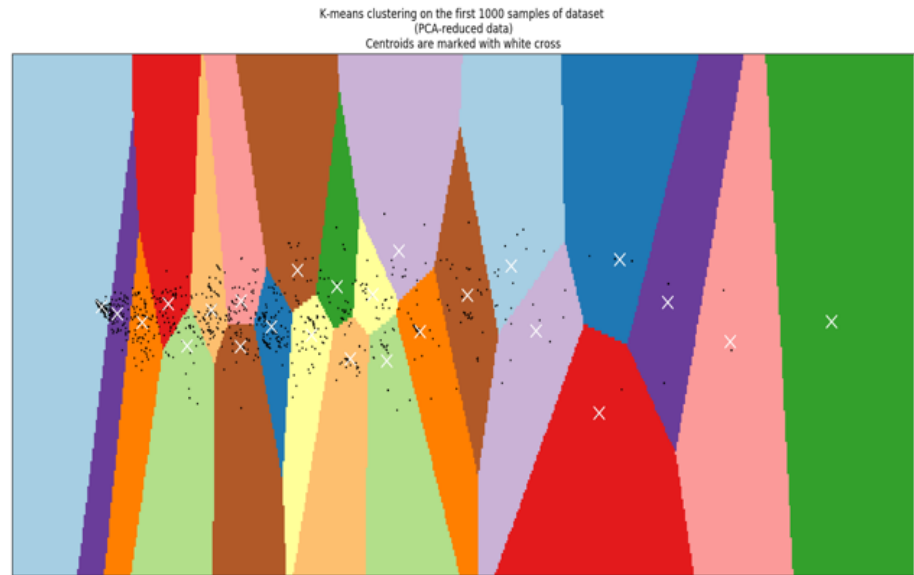
1. Using Machine Learning to Predict Response Time on Stack Overflow

1,307,172 posts

89.11%



39%



My Research Projects

2. Using Machine Learning to Detect Ransomware Attacks



[Innovative Integration, Inc](#)

My Research Projects

2. Using Machine Learning to Defend Against Ransomware Attacks

```
data.head()
```

	FuzzyHash	ShannonEntropy	Response
1	97	0.076237	0
2	97	0.054600	0
3	97	0.052020	0
4	99	0.012486	0
5	96	0.011390	0

```
data.tail()
```

	FuzzyHash	ShannonEntropy	Response
56	0	2.771617	1
57	0	2.481546	1
58	0	2.280617	1
59	0	2.386087	1
60	0	3.211741	1

My Research Projects

3. Using Machine Learning to Detect Symptoms of Chronic Kidney Disease

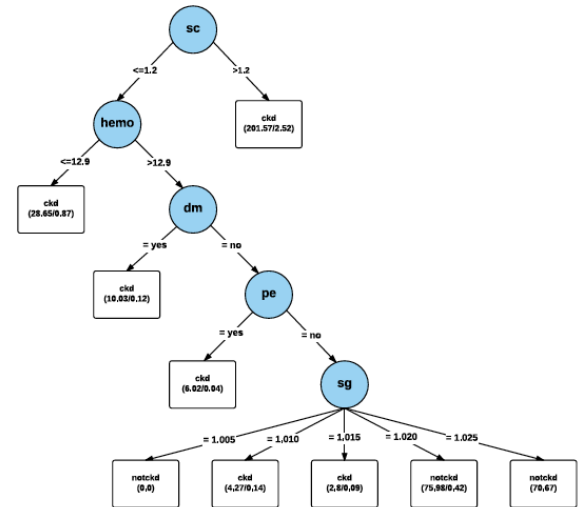


[Veredus' Lab-On-A-Chip](#)

My Research Projects

3. Using Machine Learning to Detect Symptoms of Chronic Kidney Disease

24 features collected from 400 patients



Features	Classifier	Accuracy rate	RMSE	MAE	Kappa Statistics
S4 (Our Proposed feature-subset)	C4.5 DT	99 %	0.0805	0.0225	0.9786
S5 (A. Salekin and J. Stankovic (9))	C4.5 DT	98 %	0.1072	0.0329	0.9572

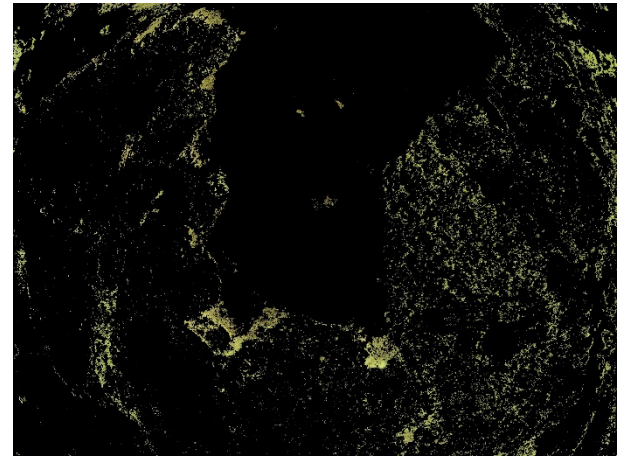
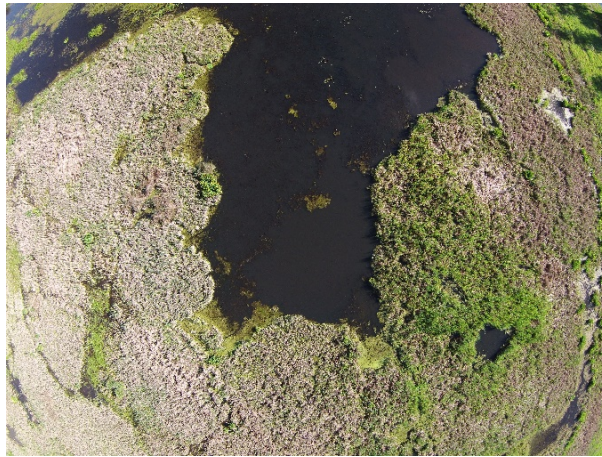
My Research Projects

4. Fusing image processing and machine learning to identify invasive plant species in high resolution images



My Research Projects

4. Fusing image processing and machine learning to identify invasive plant species in high resolution images



My Research Projects

5. Predicting the outcome of future soccer matches



My Research Projects

5. Predicting the outcome of future soccer matches

200,000 soccer matches

	Team	ACC	RPS
13	Team DBL4 **	0.5194175	0.2054196
1	Team OH	0.5242718	0.2063071
8	Team ACC	0.5145631	0.2082558
4	Team FK	0.5388350	0.2086510
10	Team DBL1 **	0.5048544	0.2149250
6	Team HEM	0.4660194	0.2176647
12	Team DBL3 **	0.4563107	0.2210731
15	League Priors***	0.4514563	0.2254204
2	Team EB	0.4854369	0.2258271
14	Global Priors***	0.4514563	0.2260854
9	Team LJ *	0.4126214	0.2312974
11	Team DBL2 **	0.3640777	0.3469738
7	Team AT	0.3883495	0.3980583
3	Team LHE	0.3398058	0.4514563
5	Team EDS	0.3592233	0.4514563



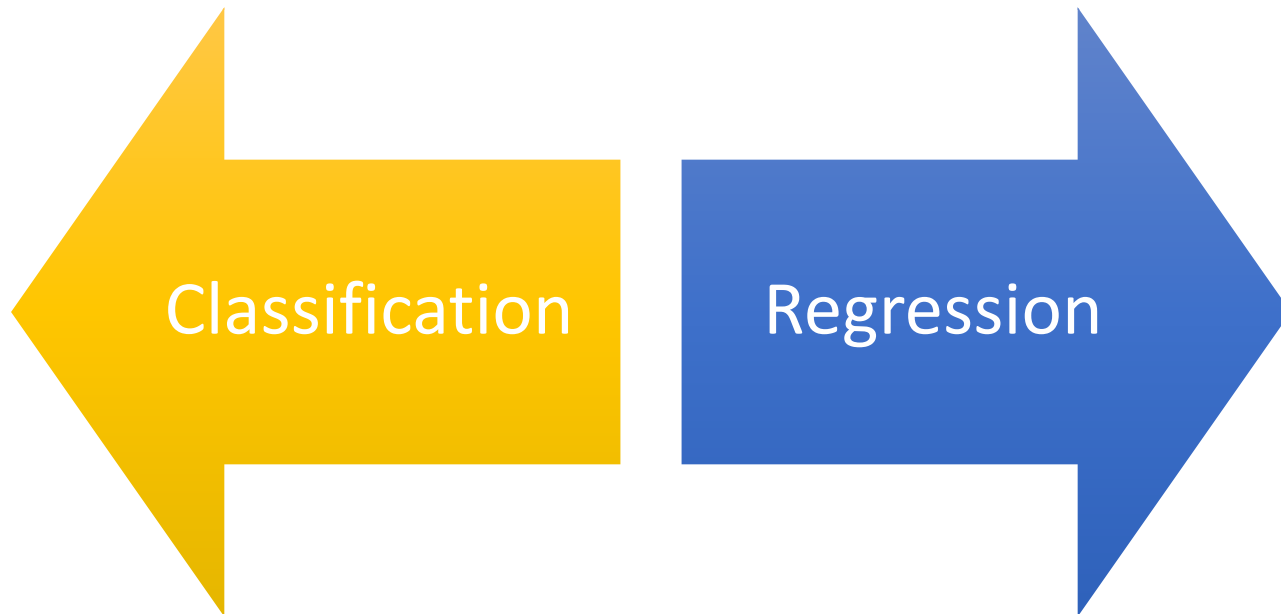
My Research Projects

6. Using Keystroke Dynamics to Verify the Identity of Smartphone Users



Image: Reuters

Machine Learning



Distance Learning Education

Advantage:

- Provides opportunities for students to pursue their education where and when they like.

Challenge:

- Ensuring Academic Integrity in Distance Education.

Using Technology to Verify Identity

- ✓ One-Time Authentication
- ✓ Continuous Authentication

Types of Authentication

Passwords

Aw&234mn\$%

Tokens

023456122595

Biometrics

Physical & Behavioral

Types of Authentication

Physical

- Fingerprint
- Face Recognition
- etc.

Behavioral

- Gait Analysis
- Keystroke Dynamics
- etc.

Keystroke Dynamics

The way you type is unique



Image: Wikimedia Commons:https://www.google.ca/url?ai=i&cc=j&sc=8&source=images&cd=8&cad=rja&uact=8&ved=0ahUKEwi3pSp46TAhULGMKH9NF074Qjtw@w&url=http://3ANL2F2fcommons.wikimedia.org/wiki/File:3A3Abacklit_keyboard.jpg&vrm=br.151325232_d_cG&pg=APQ/CNHQNS/E9GmraW_GyrbHGPmERQ&ust=1481240960307826

Keystroke Dynamics

What happens when you touch the screen?



https://www.youtube.com/watch?v=FyCE2h_yjxI

Image: https://www.google.ca/url?sa=i&ict=j&eq=&source=images&cd=&cad=rj&uact=8&ved=0ahUKEwjp4DkYt6TAhUGGMtORH_CFOQ&w@w&url=http%3A%2F%2Fwww.googleguide.com.au%2Farticle%2F355922%2Fcapactive_vs_resistive_touchscreen%2F&pg=AFQjCNP2e5hV51nBpcep2LboKCD3fghQ&ust=1491242603430154

Keystroke Dynamics - Touch Events

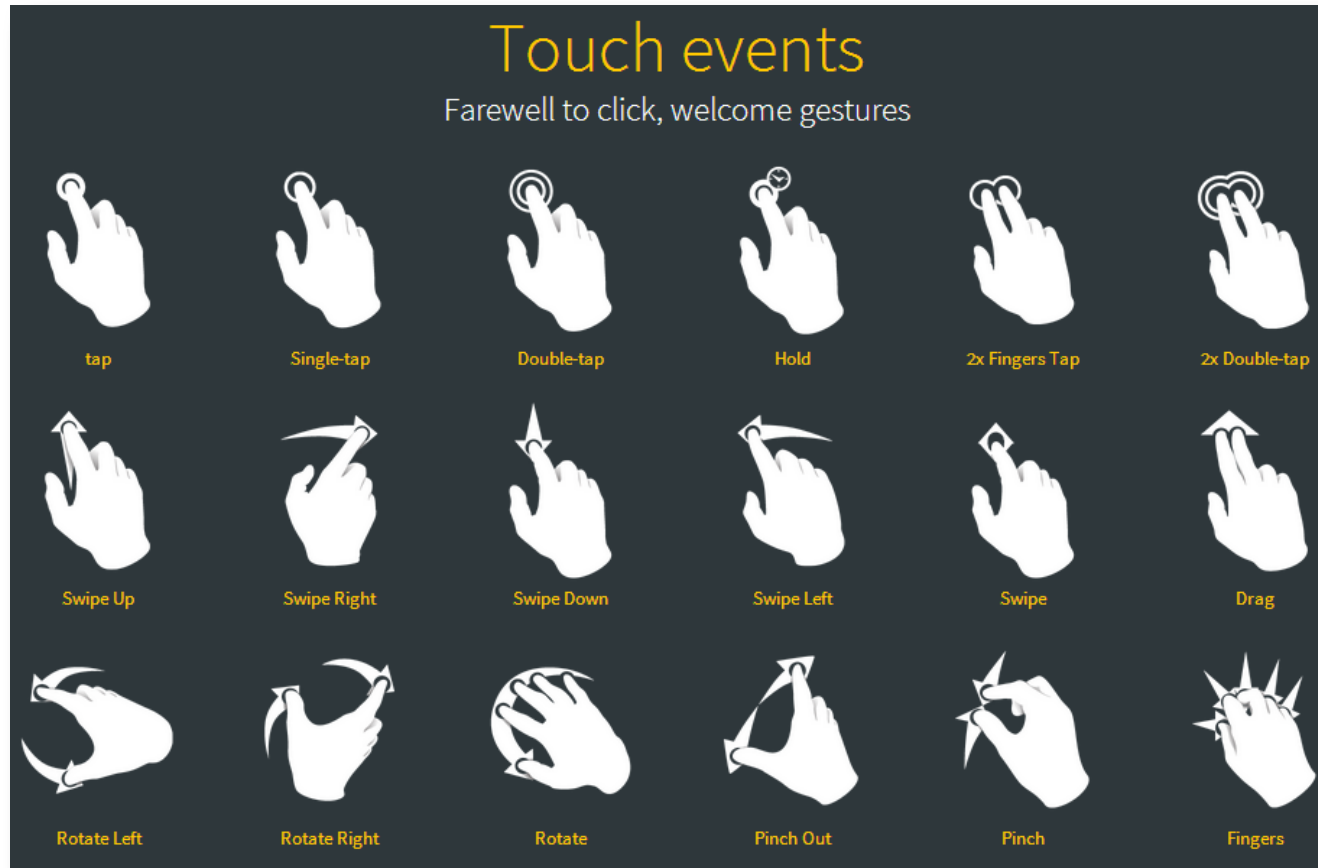
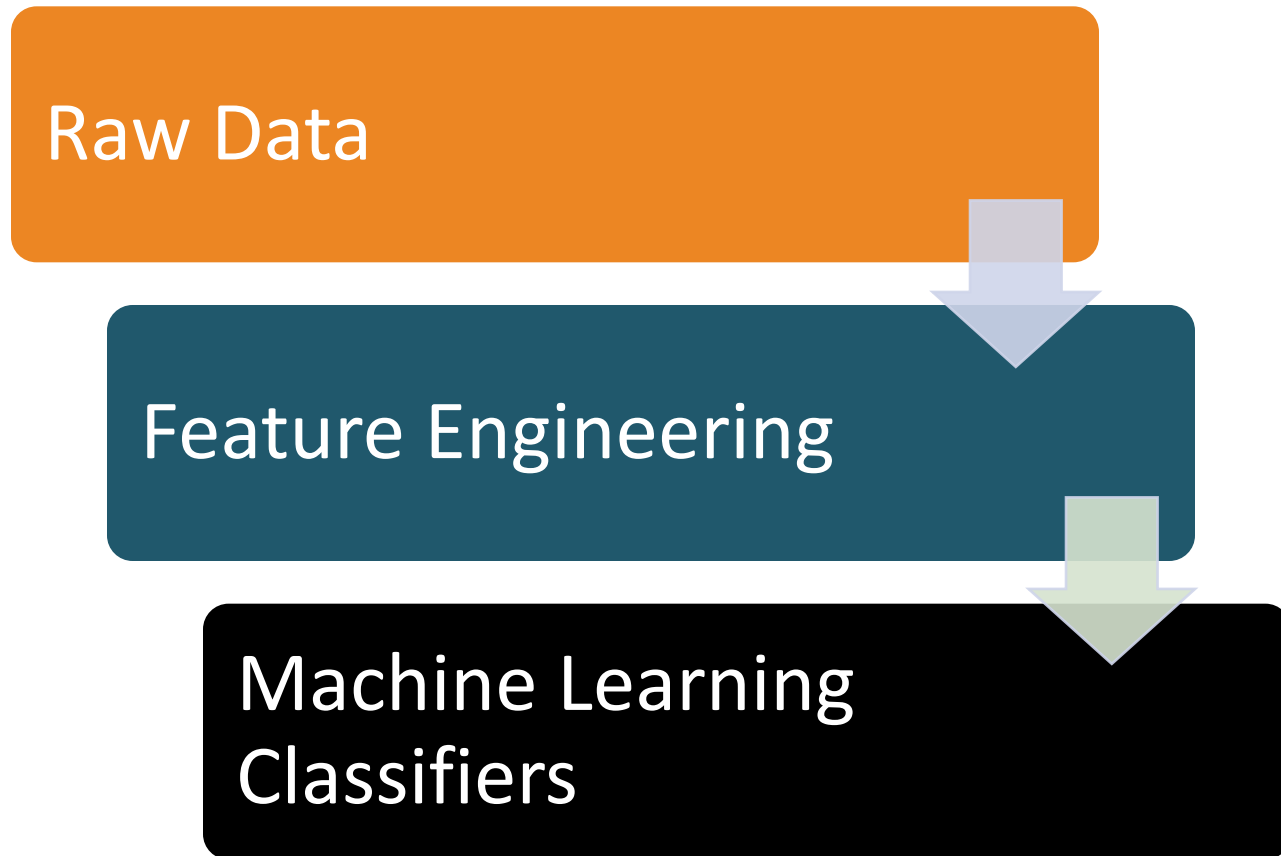
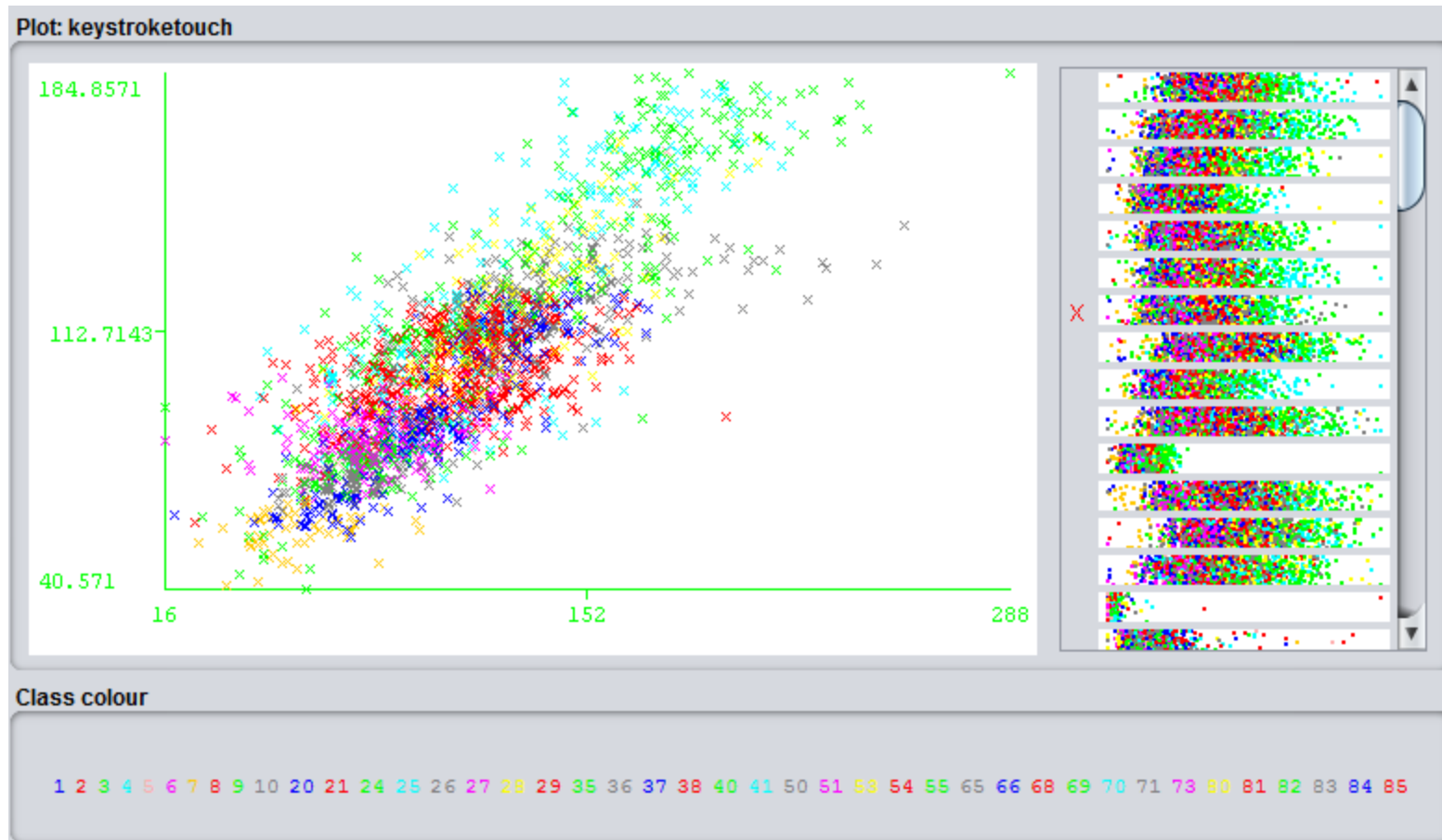


Image: https://www.adimedia.net/wp-content/uploads/2013/09/touch_events.png

Keystroke Dynamics - Design Flow



ML classifiers try to identify predictive features



to correctly classify (and, hence, identify) users



Keystroke Dynamics - Literature Review

- How many features can we extract from touch events?

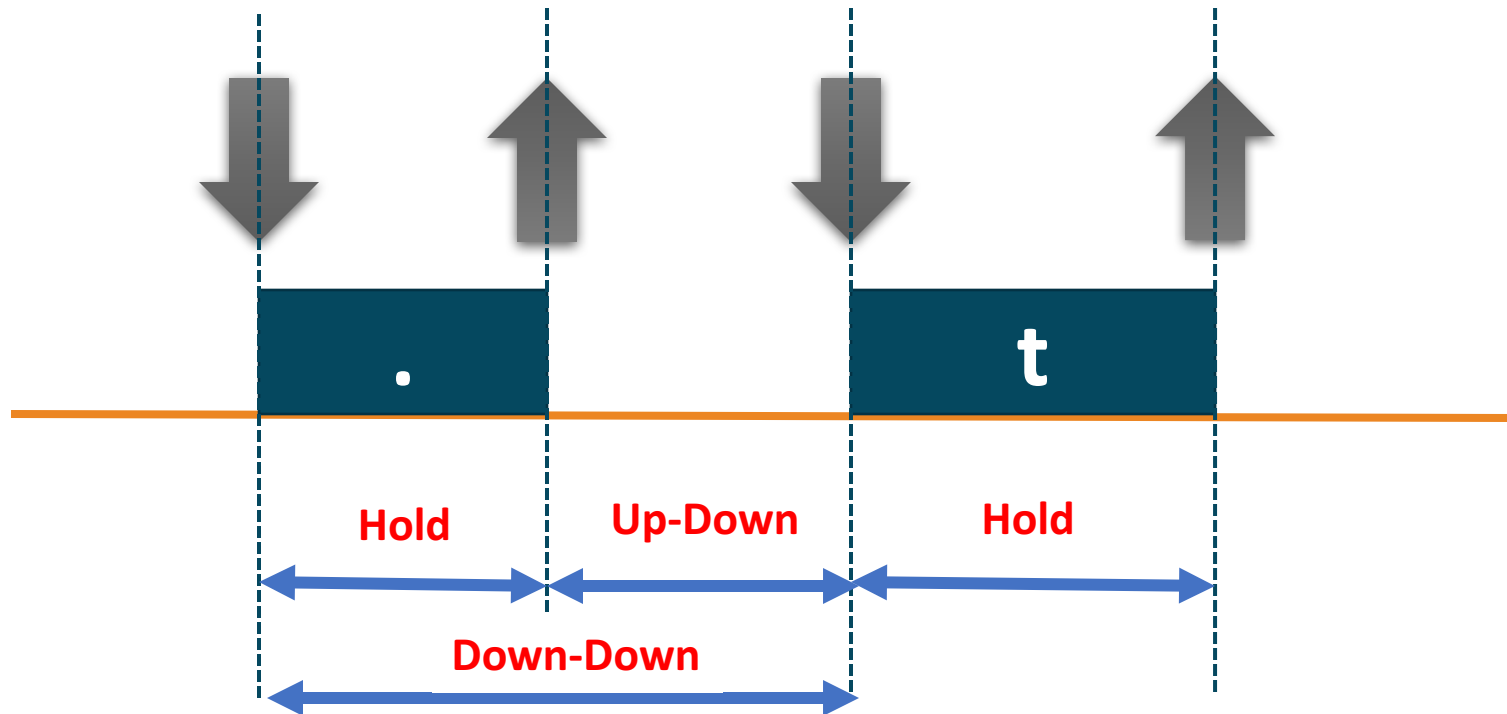
.tie5Ronald

71 Features

M. Antal, L.Z. Szabó, *Keystroke dynamics on android platform*. *Procedia Technol.* 19, 820–826 (2015). In: 8th International Conference Interdisciplinarity in Engineering

Feature Engineering- Literature Review

.tie5Ronald



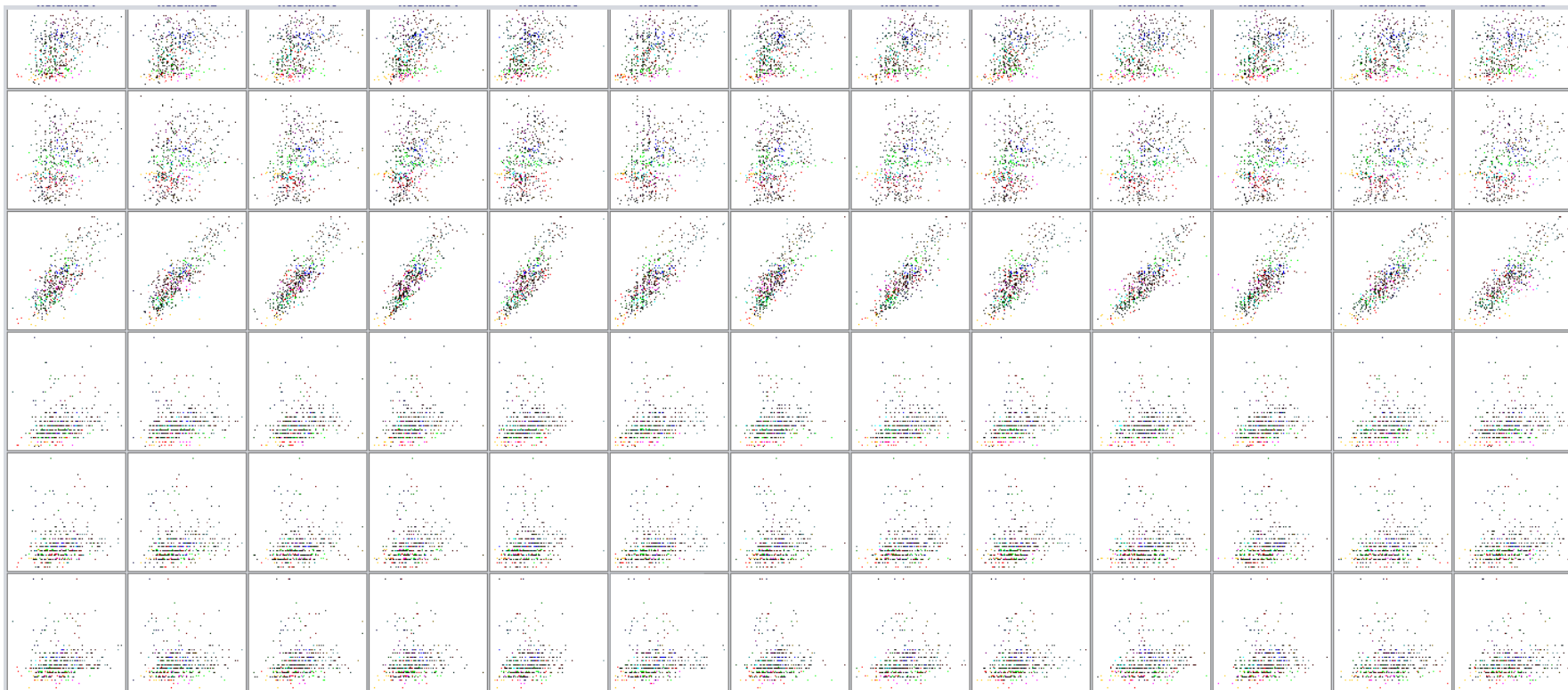
Feature Engineering- Literature Review

.tie5Ronal

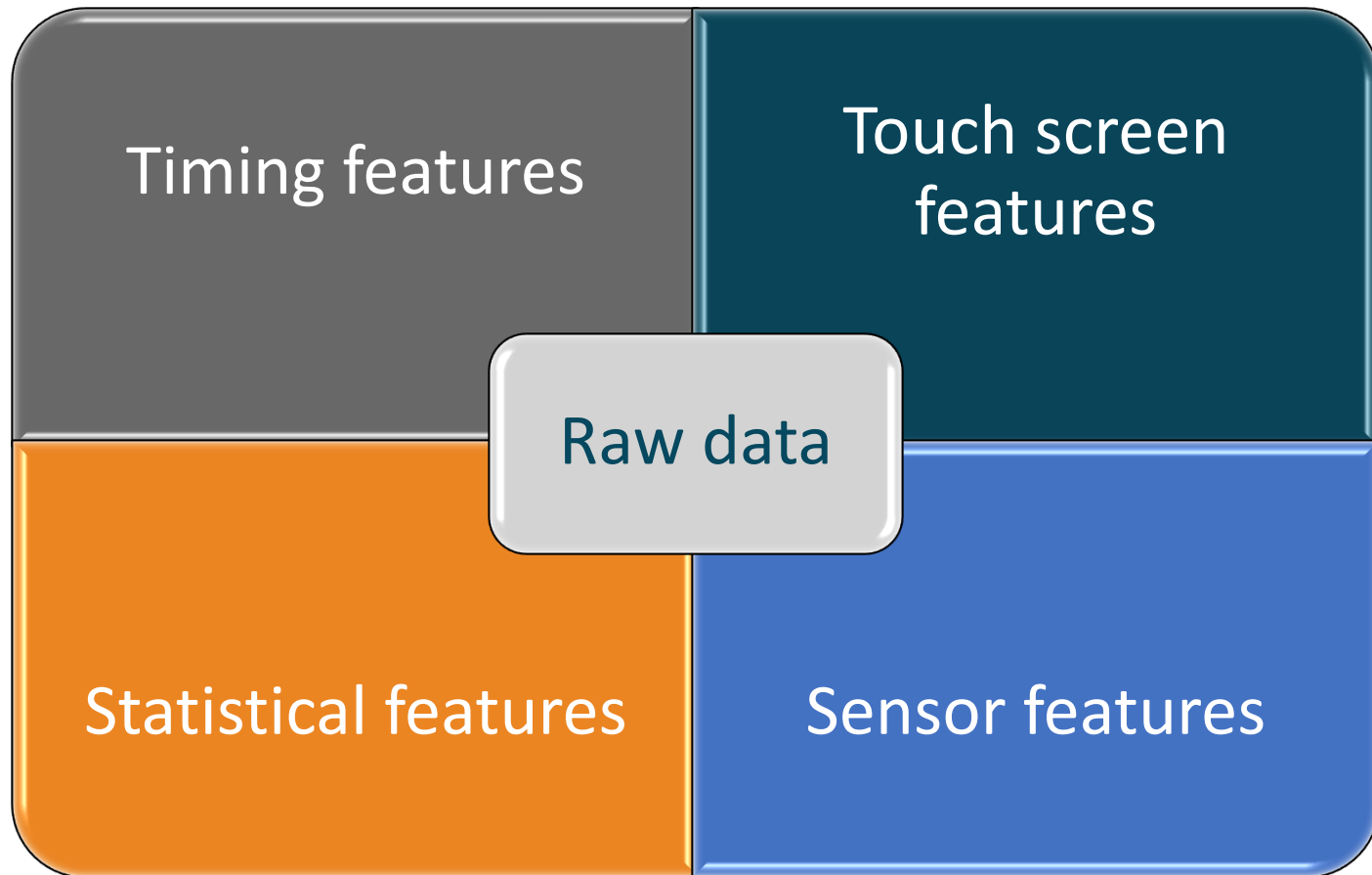
Feature name	Explanation	Number of features
Key hold time (H)	Time between key press and release	14
Down-down time (DD)	Time between consecutive key presses	13
Up-down time (UD)	The time between key release and next key press	13
Key hold pressure (P)	Pressure at the moment of key press	14
Finger area (FA)	Finger area at the moment of key press	14
Average hold time (AH)	Average of key hold times	1
Average finger area(AFA)	Average of key finger areas	1
Average pressure (AP)	Average of key pressures	1
Total		71

M. Antal, L.Z. Szabó, *Keystroke dynamics on android platform*. *Procedia Technol.* 19, 820–826 (2015). In: 8th International Conference Interdisciplinarity in Engineering

Keystroke Dynamics Features



Feature Engineering- Literature Review



Feature Engineering: iProfile

.tie5Ronald

156 Features

Feature Engineering: iProfile

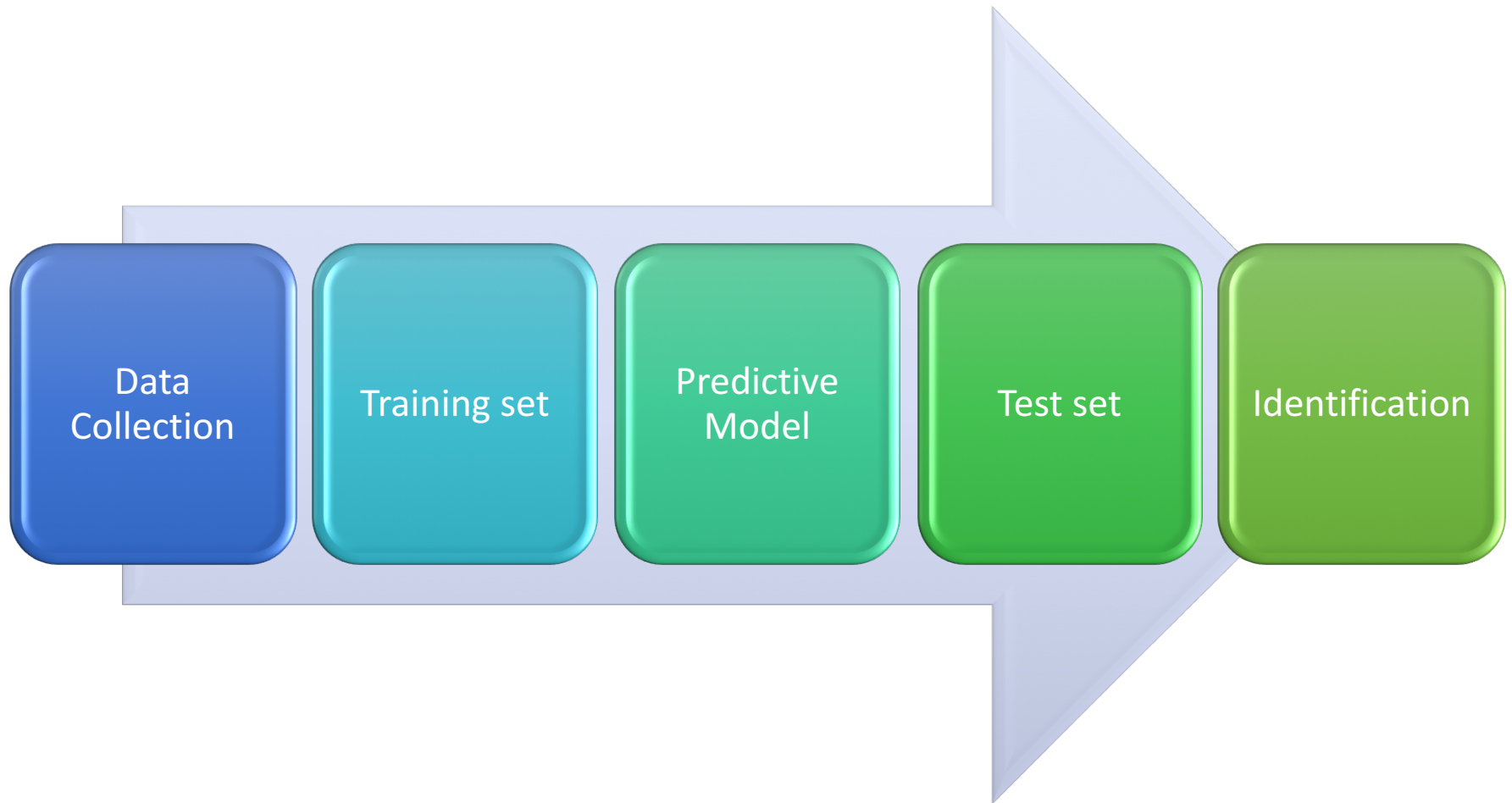
.tie5Ronal

- More Timing Features (Tri-graph)
- X & Y Precision
- X & Y Coordinates
- Device Signature
- Sensors

.tie5Ronal



Machine Learning - Supervised Learning



Machine Learning



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English, Sony

D6503,22.0,Sony,4.85637962532,America/Vancouver,CA,4.0,0.40331491828,0.41988950
9678,0.44198897481,0.458563566208,0.436464101076,0.563535928726,0.4696132838
73,0.56906080246,0.447513818741,0.458563566208,0.464088410139,0.497237592936,
0.674033164978,0.469613283873,0.53038674593,0.497237592936,0.0,0.0,0.0,0.0,0.
0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,0.0,
1605.53556017,1435.08147842,1187.54371365,1
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80506,1500.15219185,1614.20516369,1258.14539374,1410.80672521,1199.36755741,1
588.6613862,1222.80351479,2.0,2.0,2.0,2.0,2.0,2.0,2.0,2.0,2.0,2.0,2.0,2.0,2.0,2.0,
86.0,77.0,68.0,77.0,86.0,77.0,68.0,68.0,85.0,112.0,85.0,60.0,75.0,69.0,84.0,51.0,192.0,26
0.0,105.0,35.0,113.0,105.0,764.0,11103.0,754.0,105.0,399.0,46.0,54.0,572.0,477.0,278.0,
337.0,173.0,112.0,199.0,182.0,832.0,11171.0,839.0,217.0,484.0,106.0,129.0,641.0,561.0,
269.0,328.0,182.0,121.0,190.0,173.0,832.0,11188.0,866.0,190.0,459.0,121.0,123.0,656.0,
528.0,355.0,405.0,250.0,198.0,276.0,250.0,900.0,11256.0,951.0,302.0,544.0,181.0,198.0,
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73

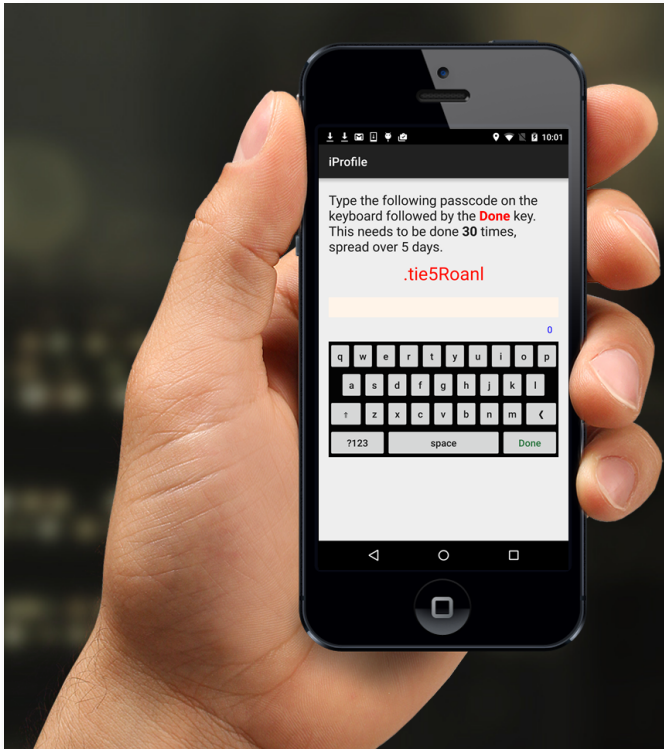
Image: https://www.google.ca/url?hl=fr&lr=&imgref=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwjp4DkYt6TAhUQ6GMt0H8_CFOQwIwBw&url=http%3A%2F%2Fwww.google.com.au%2Farticle%2F35592%2Fcapactive_vs_resistive_touchscreen%2F&pg=AFQjCNF2e5Hv51nBp2p2LBoKd3FgQ&ust=149124260430154

Performance Evaluation

- Cross Validation
- Correctly Classified Instances
- False Acceptance Ratio
- False Rejection Ratio
- Equal Error Rate

iProfile Project:

[*http://www.iprofileapp.com/*](http://www.iprofileapp.com/)



Keystroke Dynamics: Theory and Practice

Keystroke dynamics refer to the unique patterns of rhythm and timing-based features that are created when a user types on a keyboard.

Get the App from GooglePlay >

Demo

- iProfile App

