



## **Beginning a more informed discussion on the privacy and consumer protection implications of Facial Recognition Technology**

### **NTIA Privacy Multi-stakeholder Process:**

**25 March 2014**

The NTIA's present inquiry must be based on a solid foundation that objectively analyzes actual commercial Facial Recognition (FR) developments, places its use in the context of the multi-dimensional and cross-platform contemporary data-driven practices, identifies its implications beyond consumer concerns to reflect upon its broader societal impact (such as civil liberties), and engages with legal frameworks or proposals that have or could address how FR should be properly regulated.<sup>1</sup> Given that the focus of the Commerce Department-led proceeding is to help implement the Obama Administration's Consumer Privacy Bill of Rights (CPBR), stakeholders should also address how FR should be dealt with in related legislation and identify the specific CPBR principles inherent in such a discussion (such as "Individual Control," "Respect for Context," "Accountability," etc.).<sup>2</sup>

*To help promote a more informed discussion of actual FR and related biometric data practices, CDD provides this initial overview on ten of the hundreds that could be cited.*

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<sup>1</sup> See, for example, Electronic Privacy Information Center, "Comments of the Electronic Privacy Information Center to the Federal Trade Commission, Face Facts: A Forum on Facial Recognition, Project Number P115406," 31 Jan. 2012, <http://epic.org/privacy/facerecognition/EPIC-Face-Facts-Comments.pdf>; Federal Trade Commission, "Facing Facts: Best Practices for Common Uses of Facial Recognition Technologies," Oct. 2012, <http://www.ftc.gov/sites/default/files/documents/reports/facing-facts-best-practices-common-uses-facial-recognition-technologies/121022facialechrpt.pdf> (both viewed 18 Mar. 2014).

<sup>2</sup> The White House, "We Can't Wait: Obama Administration Unveils Blueprint for a 'Privacy Bill of Rights' to Protect Consumers Online," 23 Feb. 2012, <http://www.whitehouse.gov/the-press-office/2012/02/23/we-can-t-wait-obama-administration-unveils-blueprint-privacy-bill-rights> (viewed 20 Mar. 2014).

## 1. Brickstream

Promising “[a]nalytics from the front door to the back wall” of retail locations, Brickstream offers both hardware and software solutions for real-world behavioral analytics.<sup>3</sup> “Knowing how many people came into the store, how many purchased, where they went, where they stopped and how long they waited to check out or to be serviced are all vital analytics for understanding and improving store operations,” the company explains. “Brickstream’s behavior intelligence solution is designed to provide these analytics and more. Our smart devices capture behaviors from the front door to the back wall. Our behavior intelligence platform aggregates the data and delivers actionable insights to the store and corporate management via apps designed for rapid decision making.”<sup>4</sup>

The same behavioral tracking and targeting that threatens consumer privacy online, in other words, has now come to Main Street, in the form of hidden cameras and powerful data analytics. Brickstream’s LIVE package, for example, “combines 3D customer behavior analytics, a high resolution video camera and wireless- based proximity data analytics within a single platform.

Businesses with brick-and-mortar locations (such as retail stores, grocery chains and banks) can now capture and analyze highly accurate data about visitor behavior in order to improve operations, security and marketing.

**Optional support for Smartphone Bluetooth® low energy (BLE) detection**—Enables collection of proximity data that visitors can provide via their smartphones and that is captured at displays fitted with BLE beacons. Enables analytics about repeat visitors and multi location visits, as well as dwell times and conversions at product displays. ...

Data from Brickstream Smart Devices is centrally stored and accessed in the cloud-based Brickstream BehaviorIQ® behavior intelligence platform. The IQ application series further transforms the data into actionable insights and present it in an array of useful real-time and predictive dashboards and reports that managers and executives can use to make better real-time business decisions relevant to staffing, service, and more, and to track metrics and trends over time. ...

Combining video analytics with surveillance creates multiple opportunities for Behavior Intelligence applications across multiple verticals ...<sup>5</sup>

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<sup>3</sup> Brickstream, <http://brickstream.com/> (viewed 16 Mar. 2014).

<sup>4</sup> Brickstream, “Retail Operations Teams,” <http://brickstream.com/solutions/by-role/retail-operations/> (viewed 16 Mar. 2014).

<sup>5</sup> Brickstream, “LIVE Datasheet,” <http://brickstream.com/wp-content/uploads/2014/01/Brickstream-LIVE-Datasheet-01-09-14.pdf>, emphasis in the original (viewed 16 Mar. 2014).

Among the fields for which Brickstream offers products are retail (including “sales conversion” and “in-store analytics” applications), entertainment (“video surveillance and analytics”), and financial services (“occupancy analytics”).<sup>6</sup> And like many of the most advanced FR applications today, Brickstream’s “... people-tracking solutions aim to distinguish individual people from the environments that surround them and track their locations. ...

Brickstream’s stereo platform is fundamentally different from competing technologies because it utilizes two onboard cameras to create a three-dimensional rendering of its viewable scene in real-time. ... Brickstream’s three-dimensional person templates allow people to be tracked for extended periods of time even in difficult environments such as slow-moving queues or amongst shopping trolleys, product displays, and other objects that competing systems often falsely track. ... Brickstream’s core metric set also includes queue wait times and dwell times *at the individual customer level*. Because of the complexity involved in capturing these metrics, Brickstream is the only behavior analytics provider to offer them at the accuracy level and sample size required to make critical business decisions.<sup>7</sup>

As with so much digital technology today, FR and its related hardware and software are becoming increasingly affordable, especially as mobile FR apps become more prevalent. It seems likely, in fact, that before long even mom-and-pop stores will be able to engage in such surveillance.

## **2. FaceFirst**

According to the company’s website, “FaceFirst services several different markets including Retail, Law Enforcement, Airports & Transportation, Commercial Security and Gaming. The FaceFirst infinitely scalable face recognition platform was built with the ambition of achieving global scalability. For every security or customer-identification goal, FaceFirst gives you accurate alerts in seconds. FaceFirst is military-grade facial identification that communicates instantly with a vast central database, configured according to your requirements.”<sup>8</sup> If it’s good enough for our armed forces, in other words, FaceFirst will do just fine in civilian settings.

One need look no further than FaceFirst’s current gaming and retail services to get a sense of the company’s ambitions—and to recognize the enormous privacy concerns that loom on the horizon. FaceFirst’s services for the “gaming” industry are

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<sup>6</sup> Brickstream, “LIVE Datasheet.”

<sup>7</sup> Brickstream, “A Buyer’s Guide: 3D Analytics for a 3D World,” <http://brickstream.com/wp-content/uploads/2014/01/3D-Analytics-for-a-3D-World-08-26-13.pdf>, emphasis in the original (viewed 16 Mar. 2014).

<sup>8</sup> FaceFirst, “FaceFirst Markets,” <http://www.facefirst.com/services> (viewed 17 Mar. 2014).

remarkably transparent: “Maximizing your bottom line at your casinos means keeping out the compulsive gamblers, the con artists and troublemakers while providing royal treatment to the big spenders. FaceFirst makes it all possible—and makes it easy. An advanced facial recognition system, FaceFirst identifies individuals at the door, then sends alerts to authorized personnel—instantly.”<sup>9</sup>

Supporting that simple goal is an astonishingly thorough FR dragnet that monitors friends, foes, and employees alike:

- Experience better risk management. Spot litigious individuals at the door.
- Load criminal data into FaceFirst so you can notify law enforcement if someone in their database enters your casino.
- Monitor the movement of employees and others to ensure that no one is in an area in which they are not authorized.<sup>10</sup>

Perhaps most tellingly, FaceFirst allows casinos to “[r]ecognize the whales and make their stay more memorable.

- Make sure your hospitality department never misses spotting a visiting VIP again.
- Provide the best experience to increase customer loyalty and return visits.<sup>11</sup>

FaceFirst’s offerings for the retail sector are similarly bifurcated—and equally fraught with privacy risks:

**Spot and stop the bad guys.**

- Receive descriptive alerts when pre-identified shoplifters walk through any door at any store.
- Get alerts when known litigious individuals enter any of your locations.

**Recognize the good guys and treat them better.**

- Build a database of good customers, recognize them when they come through the door, and make them feel more welcome.
- Keep repeat customers coming back and spending more.<sup>12</sup>

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<sup>9</sup> FaceFirst, “Gaming,” <http://www.facefirst.com/services/gaming> (viewed 17 Mar. 2014).

<sup>10</sup> FaceFirst, “FaceFirst Gaming,” <http://www.facefirst.com/downloads> (registration required).

<sup>11</sup> FaceFirst, “FaceFirst Gaming.”

<sup>12</sup> FaceFirst, “Retail,” <http://www.facefirst.com/services/retail> (viewed 17 Mar. 2014).

### 3. 3M Cogent

Vowing to turn “promise into reality” in the FR arena, 3M’s Cogent, Inc. observes that “[o]nce the province of fiction, automated facial recognition has in just a few years emerged as more than a promise, but a distinct, doable reality.

Over millions of years, the brain has evolved to immediately identify and focus on faces, distinguish features, and search our brain’s “database” to match what we see with memories of previous faces. Teaching cameras and computers to “process faces” is the foundation of facial recognition technology:

- Identification and authentication can be made across a variety of contexts.
- As a no-touch system, all it requires for identification or authentication is that a person “shows up.”
- Existing monitoring and surveillance systems can be enhanced to automatically identify individuals.
- Unlike other biometrics, facial recognition is an ability all humans have, so operators can easily verify questionable matches.<sup>13</sup>

3M Cogent’s Facial Recognition Systems (FRS), moreover, claim to have overcome FR’s most vexing problems—that human faces are much more complex than fingerprints, that they change over time, and that facial images differ in camera angle, lighting conditions, backgrounds, and resolution—to achieve results that are as attractive to businesses as they are deleterious to consumer privacy. “3M Cogent has leveraged more than 20 years of biometrics systems engineering to invent unique computational solutions that can match faces with unprecedented accuracy, in spite of a wide range of conditions and variations,” the company boasts. “... Using proprietary statistical models with lengthy and ongoing training with real-world results, the 3M Cogent algorithms calculate the overall likelihood that an individual face match can be made using the three sets of data. ...

- 1:1 Matching—Used primarily in access control or other security situations, 1:1 matching mode compares two face images to determine if the person in both images is the same person.
- 1:Few Matching—Used to allow or disallow access, 1:Few matching uses a Watchlist module to compare a face image to a limited number of face images predetermined for identification.
- 1:N Matching—The 1: N matching mode compares a face image against all images in a database. It allows for a centralized agency or inter-agency

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<sup>13</sup> 3M Cogent, “Facial Recognition Biometric Technology,” 2011, [http://multimedia.3m.com/mws/mediawebsserver?mwsId=SSSSuH8gc7nZxtU5xmx5x\\_SevUqe17zHvTSevTSeSSSSSS--&fn=FacialRecognition\\_3MCogent\\_FINAL](http://multimedia.3m.com/mws/mediawebsserver?mwsId=SSSSuH8gc7nZxtU5xmx5x_SevUqe17zHvTSevTSeSSSSSS--&fn=FacialRecognition_3MCogent_FINAL) (viewed 15 Mar. 2014).

search and is fully scalable to meet an organization's evolving requirements.<sup>14</sup>

#### **4. Affectiva Affdex**

Affectiva's Affdex product is a "facial expression analysis technology" that promises "new insight into unspoken, spontaneous reactions to advertisements, concepts and other media content in real-time. ... Affdex scientifically measures emotional responses unobtrusively, cost effectively and at scale—no special equipment, no extra processing required. ...

Affdex is an automated facial coding solution that tracks facial expressions and head gestures in real-time, through a webcam. Using key points on viewers' faces, Affdex can recognize and track the viewers expressions as they are exhibited or changed to reflect their emotional and cognitive states, such as confusion, dislike and enjoyment.

Affdex analyzes and aggregates individual emotion responses, and uses an interactive dashboard that provides moment-by-moment analysis of the emotional track with dynamic segmentation by emotion and survey responses.<sup>15</sup>

For better or worse, Affdex's power resides not simply in its analytical prowess, but also in the vast database of facial expressions that Affectiva has compiled over the years. "With over 300 million facial frames and growing," the company proclaims, "Affdex owns the world's largest database of naturally occurring facial expressions to power its sophisticated facial recognition algorithms."<sup>16</sup> And therein lies the danger inherent in Big Data's fascination with FR and other neuroscience-related marketing techniques. As the company explains in a revealing white paper entitled "Automated Facial Coding: Delivering Easy & Affordable Neuroscience Insights," by "'reading' faces inexpensively and at scale, Affdex introduces a cost-effective neuroscience technique that can be easily incorporated into existing quantitative and qualitative studies to add rich insights into communication and engagement effectiveness. ...

Affdex delivers authentic emotion insights by employing advanced computer vision and machine-learning algorithms, within a scalable cloud based infrastructure. While the science underlying the Affdex platform is complex, the emotion insights are easily accessible. ...

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<sup>14</sup> 3M Cogent, "Facial Recognition Biometric Technology."

<sup>15</sup> Affectiva, "Affdex Datasheet," <http://www.affdex.com/assets/AffdexDataSheet2.pdf><http://www.affdex.com/assets/AffdexDataSheet2.pdf> (viewed 15 Mar. 2014).

<sup>16</sup> Affectiva, "Affdex Datasheet."

Once respondent face videos are available in the Affdex cloud service, sophisticated computer vision algorithms process them to generate emotion metrics. Affdex Automated Facial Coding applies scientific methods to interpret viewers' emotional responses quickly and at scale.

The core of the Affdex science consists of patent-pending, emotion-sensing algorithms that take face videos as inputs and provide frame-by-frame emotion metrics as outputs. ...

The Affdex cloud-based face video process includes three distinct procedures:

- Detect & Extract Features
- Classify Emotional States
- Assess & Report Emotion Response

... Given that most Affdex data is received at 14 frames per second, Affdex is capable of capturing both subtle and fleeting facial expressions—even those lasting only a split second. ...

The Affdex analytics platform also allows us to develop models to tie emotion metrics with consumer behavior and media effectiveness measures. These models are primarily focused on:

- Likeability
- Desire to view again
- Purchase intent
- Sales effectiveness
- Virality

We continue to collaborate with leading market research firms to draw connections between emotions and behavior. Preliminary findings are promising ...<sup>17</sup>

Affdex's "two primary analytic tools are the Affdex Dashboard and the Summary Metrics," and while the former is described as "primarily a diagnostic tool," Affdex also admits that "... the stimulus media (e.g., advertisement) is synchronized with the various emotion traces to highlight which parts of the creative execution are driving which specific emotional response." The Summary Metrics are also two-edged swords, providing "... ad-specific emotion measures that are compared to

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<sup>17</sup> Affdex, "Automated Facial Coding: Delivering Easy & Affordable Neuroscience Insights," <http://info.affectiva.com/acton/form/1462/0003:d-0001/0/index.htm> (registration required).

normative benchmarks. Metrics are flagged when they are determined to be significantly different from the norm. These Norms are maintained at the market level, and requires at least 30 data points in order to establish a norm within a given market.”<sup>18</sup>

Affdex technology illustrates the relationships among FR, predictive analytics, and the growing use of neuromarketing, an invasive form of interactive advertising that uses technologies designed for brain research, such as fMRIs and EEGs, to create online and other marketing campaigns.<sup>19</sup> Neuromarketers, the “hidden persuaders” of the digital age, deliver finely honed messages—tailored to individual needs and vulnerabilities—that effectively bypass the rational part of the brain and zero in on one’s emotional state. The impact of FR techniques on the development of messages and practices designed to influence subconscious behavior should be the focus of further research by the NTIA.<sup>20</sup>

## 5. VisualEmotion

Because “actions speak louder than words,” as VisualEmotion LLC expresses it, the company “... provides insight, analysis and understanding of non-verbal behavior. Using principles from cutting-edge research in the areas of facial coding, emotion recognition, deception detection and body language, we apply proven scientific behavioral analysis techniques across a wide variety of contexts to serve the needs of our clients.”<sup>21</sup> Since its founding in 2006, “... VisualEmotion has been providing facial expression coding, interpretation and analysis using the Facial Action Coding

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<sup>18</sup> Affdex, “Automated Facial Coding: Delivering Easy & Affordable Neuroscience Insights.”

<sup>19</sup> See, for example, Center for Digital Democracy and U.S. PIRG, “Information Privacy and Innovation in the Internet Economy, U.S. Department of Commerce, Docket No. 101214614-0614-01, Comments of the Center for Digital Democracy and U.S. PIRG, Protecting Consumers in the Digital Marketplace,” 28 Jan. 2011, <http://www.centerfordigitaldemocracy.org/cdd-and-uspig-urge-commerce-department-protect-consumers-online> (viewed 18 Mar. 2014).

<sup>20</sup> See, for example, Nielsen, “Consumer Neuroscience,” <http://www.nielsen.com/us/en/nielsen-solutions/nielsen-measurement/consumer-neuroscience.html>; Millward Brown, “Millward Brown Highlights Neuromarketing Leadership,” 22 Jan. 2014, [http://www.millwardbrown.com/Global/News/PressReleases/PressReleaseDetails/14-01-22/Millward\\_Brown\\_Highlights\\_Neuromarketing\\_Leadership.aspx](http://www.millwardbrown.com/Global/News/PressReleases/PressReleaseDetails/14-01-22/Millward_Brown_Highlights_Neuromarketing_Leadership.aspx); R. Mark Wilson, Jeannie Gaines, and Ronald Paul Hill, “Neuromarketing and Consumer Free Will,” *Journal of Consumer Affairs* 42, n. 3 (Fall 2008): 389–410, <http://class.classmatandread.net/Physio/neurofreewill.pdf> (all viewed 20 Mar. 2014).

<sup>21</sup> VisualEmotion LLC, <http://www.facscodinggroup.com> (viewed 15 Mar. 2014).



System (FACS). Through the study and analysis of involuntary facial expressions, our services help clients discover what words often mask: the truth.”<sup>22</sup>

FACS itself has a lengthy history in the field of psychology, although its more recent leap from the laboratory to the retail market illustrates the issues we must better address. “The Facial Action Coding System (FACS),” VisualEmotion explains, “is an internationally recognized, sophisticated research tool that precisely measures the entire spectrum of human facial expressions. FACS has elucidated the physiological presence of emotion with very high levels of reliability. In fact, it has predicted patterns related to deception at about 80% accuracy. Created in the 1970s by psychologists Paul Ekman and Wallace V. Friesen FACS provides a comprehensive taxonomy of human facial expressions. FACS remains the most widely used and acclaimed method for coding the minutest movements of the human face.”<sup>23</sup> While no one would dispute the value of such techniques in medical and counseling applications, the deployment of FACS in commercial settings, especially when consumers are not fully apprised of its use, raises a number of concerns. As VisualEmotion makes clear, its use of FACS stands the traditional notion of therapy on its head, with all of the benefits of FACS redounding to the agent rather than the patient: “Emotional expression transcends the barriers of race, ethnicity, culture, gender, religion and age. Regardless of background, humans express facial emotions in exactly the same way. The ability to read emotional behavior is an indispensable component of effective communication. FACS utilizes these concepts to benefit those who conduct interviews, interrogations and business transactions as well as those involved in law enforcement, security and the legal and healthcare systems.”<sup>24</sup>

As the Marketing Research Association detailed in a white paper prepared for an earlier session of the current NTIA Multi-stakeholder process, facial coding applications of the type that VisualEmotion, undertakes are already capable of remarkably detailed emotional tracking and analysis, having reached the following benchmarks:

- Can identify the slightest movements in facial musculature uncovering even the subtlest emotional reactions in subjects;
- Can identify the exact emotion felt as well as the time frame including start/peak/end and duration of an emotional reaction;
- Can identify all facially expressed emotional reactions across a given sequence or stimulus duration;
- Can capture emotional reactions during both speaking and non-speaking occurrences; and

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<sup>22</sup> VisualEmotion, “About VisualEmotion,” <http://www.facscodinggroup.com/about> (viewed 16 Mar. 2014).

<sup>23</sup> VisualEmotion, “Facial Action Coding System,” <http://www.facscodinggroup.com/about/facs> (viewed 16 Mar. 2014).

<sup>24</sup> VisualEmotion, “Facial Action Coding System,” emphasis added.

- Is a non-invasive tool allowing for subjects to remain unaware/impervious to the behavioral analysis.

Facial recognition also plays a key role in eye tracking. Rather than being used to personally identify an individual or to connect them to other personally identifiable data, facial recognition is necessary for cameras to identify where a respondent is in space so that, for example, infrared cameras can be properly positioned and manage to track corneal reflections.<sup>25</sup>

## 6. Animetrics FaceR MobileID

Animetrics is among the leaders in efforts to “democratize” FR through mobile applications. As the company explains, its FaceR MobileID product “... takes the power of facial biometric comparison and identification to the mobile device.” Although it was “[d]eveloped to address the unique needs of law enforcement, private security, homeland security, civil defense and military personnel, MobileID leverages the on-board resources of smartphones, digital cameras or other hand-held devices to provide accurate digital identification technology in the field, where it is needed instantly.”<sup>26</sup> Animetrics touts the power of its system: “Powerful FACEngine technology [that] transforms flat 2D facial images into 3D avatar and unique facial signatures; Facial images/signatures scored and enrolled in FIMS [FaceR Identity Management Solutions] database; Powerful search and analysis capabilities match them against the stored enrolled images in the FIMS database or third-party database; [and] ... management and control for Animetrics FaceR applications.”<sup>27</sup>

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<sup>25</sup> Marketing Research Association, “The Marketing Research Applications of Facial Recognition Technology,” 6 Feb. 2014, [http://www.marketingresearch.org/sites/mra/files/pdfs/MRA\\_facial-recognition-MR-applications\\_2-6-14.pdf](http://www.marketingresearch.org/sites/mra/files/pdfs/MRA_facial-recognition-MR-applications_2-6-14.pdf). See also VisualEmotion LLC, “Areas of Application,” <http://www.facsodinggroup.com/about/areas-of-application> (viewed 15 Mar. 2014).

<sup>26</sup> Animetrics, “FaceR MobileID: Facial Biometric Search Made Mobile,” [http://animetrics.com/wp-content/uploads/2012/09/animetrics\\_mobileid\\_datasheet.pdf](http://animetrics.com/wp-content/uploads/2012/09/animetrics_mobileid_datasheet.pdf) (viewed 16 Mar. 2014).

<sup>27</sup> Animetrics, “FaceR Identity Management Solution,” <http://animetrics.com/facer-identity-management-system/>. Despite Animetrics CEO Paul Schuepp’s self-serving protestation that the NTIA is “jumping the gun” with its current discussions of the need to regulate FR technology in order to protect consumer privacy (in a *Forbes* op-ed tellingly entitled “Facial Recognition’s Newest Obstacle: Bureaucrats and Regulators Who Assume There’s a Problem”), it doesn’t take much imagination to see where commercial FR is headed. Nevertheless, Animetrics insists, “Guidelines at this stage could stymie progress in a very promising market, and could kill investment in a growing, marketable area when the U.S. economy badly needs a boost from innovation. At worst, it could hinder the rules that our law enforcement community play by and make it even more difficult for them to prosecute.” Paul Schuepp, “Facial Recognition’s Newest Obstacle: Bureaucrats and Regulators Who

Animetrics and other FR marketers like to sound a pious note in their invocations of homeland security and law enforcement, but the real market for FR—as even Animetrics acknowledges—lies elsewhere. “The opportunity for facial biometrics is very real and holds the potential for a new generation of applications that we can’t even envision today,” Animetrics CEO Paul Schuepp declares. “... Thanks to cloud computing, a new generation of Web-based applications and services are coming to market, developed by entrepreneurs taking advantage of the white hot API market. These applications can perform a wide range of tasks (more accurately than ever) at lower and lower prices. ... Adoption of facial recognition capabilities beyond the criminal investigative role is coming, and innovators are building systems for the retail environment of the future.”<sup>28</sup>

## 7. Cognitec FaceVACS

Calling itself “the face recognition company,” Cognitec plies its FR trade in a wide variety of contexts beyond traditional law enforcement, intelligence, and security applications: real-time video screening and analytics, facial scanning against database comparisons, passport-photo-verified entry systems, portrait acquisition and assessment for photo-ID documentation, intelligent signage, and a software development kit that “enables customers to develop new face recognition applications.”<sup>29</sup> Like many other FR vendors, Cognitec is seeking to find new markets for its technology, explaining that “[w]hile the main markets for face recognition technology remain identity management and physical security, use cases now also include commercial applications for personal use, convenience, productivity enhancement and more. ... Face recognition applications are gaining ground in everyday life.”<sup>30</sup>

At the heart of Cognitec’s system is its FaceVACS technology, the result of nearly “20 years of algorithm research and optimization [that] have resulted in outstanding independence from facial variances such as pose, mimic, age variance, different hair styles, glasses or temporary lighting changes.” The FaceVACS-DBScan with Examiner, for example, “compares images from different sources to those stored in

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Assume There's a Problem,” *Forbes*, 4 Feb. 2014, <http://www.forbes.com/sites/ciocentral/2014/02/04/facial-recognition-newest-obstacle-bureaucrats-and-regulators-who-assume-theres-a-problem/> (both viewed 16 Mar. 2014).

<sup>28</sup> Schuepp, “Facial Recognition's Newest Obstacle: Bureaucrats and Regulators Who Assume There's a Problem.”

<sup>29</sup> Cognitec, “Products,” <http://www.cognitec-systems.de/products.html>; Cognitec, “FaceVACS-SDK,” <http://www.cognitec-systems.de/facevacs-sdk.html> (both viewed 17 Mar. 2014).

<sup>30</sup> Cognitex, “Applications,” <http://www.cognitec-systems.de/applications.html> (viewed 17 Mar. 2014).

multi-million image databases; the Examiner tool set offers powerful tools for image enhancement and inspection,” while the FaceVACS-VideoScan “detects and identifies persons of interest in real time while computing demographic and behavioral data, supporting security staff, marketing departments and operations management with one application.”<sup>31</sup>

Like a lot of FR companies seeking to grow beyond barricades and blacklists, Cognitec sees promise in “VIP recognition” as well. “An example of a ‘positive watch list’ application,” Cognitec explains, “the software is used to automatically identify registered customers in stores, casinos, clubs or bank branches, allowing them access or notifying staff to provide special treatment.”<sup>32</sup> Such technology is also an open invitation to all manner of discriminatory practices, racial profiling, and the worst kind of stereotype-casting, however.

## 8. IMRSV Cara

The real key to “adaptive advertising”—malleable marketing that makes on-the-fly adjustments in response to interactions with specific individuals—is not the identity of the user, but rather the collection of as much information as possible about that user.

At its simplest, IMRSV’s “Cara is a platform for audience measurement. Cara gathers robust, real time analytics: gender, age, attention time and even emotions using a basic web camera. ... Cara provides access to new worlds of information. The potential is virtually limitless. Explore practical applications of Cara to begin to see the possibilities.”<sup>33</sup> Less simple (but no more forthright), IMRSV describes Cara as “[a] perceptive computing platform. Computers with human-like senses—the ability to see, hear and feel much like people do—has long been a subject of science fiction but is now within reach. Cara is our first step, it enables a future of emotion-aware devices.” More to the point, Cara is a veritable vacuum cleaner of behavioral data—claims of “anonymity” notwithstanding—sweeping up what it calls “engagement data” (e.g., total time a consumer is in front of the camera), “demographic data” (e.g., gender, age group, and emotions displayed), and “viewer attributes” (e.g., the viewer’s X/Y coordinates, viewer ID, face image width and height, distance from the camera, and unspecified “real-time analytics”).<sup>34</sup> Promising “real world analytics,” IMRSV tells its Cara clients that they will be able to “[m]easure physical

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<sup>31</sup> Cognitec, “The Face Recognition Company,” <http://www.cognitec-systems.de/files/layout/downloads/Cognitec-Brochure.pdf> (viewed 17 Mar. 2014).

<sup>32</sup> Cognitec, “Commercial and Service-based Applications,” <http://www.cognitec-systems.de/applications-commercial.html> (viewed 17 Mar. 2014).

<sup>33</sup> IMRSV, “Cara: A New Way to Measure the World,” <https://www.imrsv.com/> (viewed 17 Mar. 2014).

<sup>34</sup> IMRSV, “Personalized Computing,” <https://www.imrsv.com/learn> (viewed 17 Mar. 2014).

spaces such as retail stores, end caps, vending machines, door way entrances and cash registers. Know audience demographics and foot traffic from all your locations in real time. The process is simple, streamlined and is the easiest solution to gather continuous audience analytics.”<sup>35</sup> The results of such surveillance, according to IMRSV, include 93 percent detection accuracy, 85 percent gender/age accuracy, and the ability to analyze multiple faces simultaneously.<sup>36</sup>

The point of this audience coding and analysis, of course, is adaptive advertising: “Using a standard webcam and the Cara Player software allows you to transform existing screens into displays that react to audiences in real world. ... Advertising can adapt based on the audience in real-time based on gender, age and weather.” Such advertising can assume a number of different forms and objectives:

- Smart apps that intelligently respond to users
- Spaces that automatically tweet user engagement
- Triggered events based on people ...
- Augmented reality, motion/head tracking ...
- Shopper insights
- Market Research ...
- Dynamic Digital Signage
- Retail Experiences
- Content Recommendations ...
- Gaming experience based on emotions
- Interactive and adaptive content<sup>37</sup>

“Cara technology is powerful,” the company concedes, “but it isn't just for PhD's. Cara was created for the everyday inventor and innovators like developers, digital artists, creatives and companies that want to make something amazing. Our approach is in taking complex technology and making it accessible to everyone. Cara is the world's most robust audience analytics toolkit.”<sup>38</sup>

## **9. nViso**

None of the FR companies is shy about proclaiming the merits of its products and services, so nViso's claims for its prowess in “turning emotion into insight” should come as no surprise:

nViso provides the most scalable, robust, and accurate cloud service to measure instantaneous emotional reactions of consumers in online

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<sup>35</sup> IMRSV, “What Can Cara Do?” <https://www.imrsv.com/learn-what-cara-can-do> (viewed 17 Mar. 2014).

<sup>36</sup> MRSV, “Personalized Computing.”

<sup>37</sup> IMRSV, “Personalized Computing.”

<sup>38</sup> IMRSV, “Developers,” <https://www.imrsv.com/developers> (viewed 17 Mar. 2014).

environments. We provide real-time and highly actionable information for Market Research, Brands, Creative Agencies and R&D Product Development.

Using award winning and proprietary 3D Facial Imaging technology, compatible with ordinary webcams, we uncover the why and how of customer behaviour in real-time, letting brands make smarter business decisions.<sup>39</sup>

FR services like nVisio's "Emotion Video Analytics" raise concerns, as it describes what its system can do:

nViso is able to measure the emotional response to your brand and the marketing activity that surrounds it in real time. This is accomplished by nViso's proprietary 3D Facial Imaging artificial intelligence technology that automates the recognition of facial micro-expressions exhibited by consumers while experiencing your brand. Using only simple webcams found in ordinary smart phones and computers, consumer engagement to brand experiences can be precisely quantified in natural environments, distilling the essence of those experiences with full global reach.

**MEASURE.**

What if you could accurately measure the emotions your brands evoke? Discover the emotional triggers that drive product awareness, stimulate word-of-mouth, and motivate repurchase.

**UNDERSTAND.**

Understand what drives consumer behavior in real time. nViso can measure the different emotional responses generated by a brand at many touch points.

**ENGAGE.**

Create relevant and engaging consumer experiences. Accurately gauge impact of emotional stimuli, associations, and emotional triggers.<sup>40</sup>

nViso offers to "[m]onitor emotional engagement on an ongoing basis to forecast consumer involvement with the brand, enabling continuous adjustments and improvements," and to "[r]eveal what lies beneath consumer attitudes and behavior helping to condense time at every phase of the marketing process"<sup>41</sup>

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<sup>39</sup> nViso, <http://www.nviso.ch/> (viewed 18 Mar. 2014).

<sup>40</sup> nViso, "Solutions for Brand Management," <http://www.nviso.ch/solutions-for-brand-management.html> (viewed 18 Mar. 2014).

<sup>41</sup> nViso, "Solutions for Brand Management."

Some in the FR community will suggest, of course, that nViso and similar companies would never endorse covert operations. While that may be true, nViso itself points out that its “...proprietary 3D Facial Imaging technology ... [is] compatible with ordinary webcams.” Its recent partnership with CEVA, moreover, promises “... to deliver a broad set of high quality facial analysis functions that utilizes the camera in a smartphone, tablet or any other camera-enabled device,” which nViso CEO and co-founder Tim Llewellynn described as “... ideal for implementing computer vision applications, particularly in always-on environments.”<sup>42</sup> In a 14 March 2014 interview published on IBM’s Big Data & Analytics Hub website, Llewellynn pointed out “... that there are other ways to use his facial imaging technologies including using in-store monitors to capture customer in-the-moment reactions to products and product displays that are difficult for people to recall.”<sup>43</sup> Say what nViso might, then, about respecting the privacy of consumers (and in fact the company is absolutely silent on this issue), its recent announcements suggest that it is doing everything it can to let the FR genie out of its bottle—and into the hands of whoever has the price of its software.<sup>44</sup>

## 10. Facebook

Discussions of the commercial use of FR usually begin or end with Facebook, since that social networking site, for good or ill, has brought the technology to the widest commercial audience. Even if Facebook refuses to divulge just how many “faceprints” it has collected over the years (showing respect for its own right to privacy, if not for anyone else’s), we can be sure that with more than a billion users Facebook’s biometric holdings are enormous. And growing more so everyday.<sup>45</sup> So, too, are the technological underpinnings of Facebook’s FR efforts becoming more powerful, as the following abstract of the social network’s DeepFace project, suggests:

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<sup>42</sup> “CEVA and nViso Partner to Bring 3D Facial Imaging and Advanced Emotion Recognition Technology to Mobile Devices,” PR Newswire, 20 Feb. 2014, <http://www.prnewswire.com/news-releases/ceva-and-nviso-partner-to-bring-3d-facial-imaging-and-advanced-emotion-recognition-technology-to-mobile-devices-246397851.html> (viewed 18 Mar. 2014).

<sup>43</sup> Joe Clabby, “Using IBM Watson Foundations to Read Emotions,” The Big Data & Analytics Hub, 14 Mar. 2014, <http://www.ibmbigdatahub.com/blog/using-ibm-watson-foundations-read-emotions> (viewed 18 Mar. 2014).

<sup>44</sup> On the nine pages of the nViso website, the term “privacy” is used solely for the link to the company’s own Privacy Policy (<http://www.nviso.ch/contact-privacy-policy.html>), which, like the rest of the nViso site, avoids the issue of consumer privacy entirely.

<sup>45</sup> Martin Kaste, “A Look Into Facebook’s Potential To Recognize Anybody’s Face,” NPR All Tech Considered, 28 Oct. 2013, <http://www.npr.org/blogs/alltechconsidered/2013/10/28/228181778/a-look-into-facebooks-potential-to-recognize-anybodys-face> (viewed 18 Mar. 2014).

In modern face recognition, the conventional pipeline consists of four stages: detect => align => represent => classify. We revisit both the alignment step and the representation step by employing explicit 3D face modeling in order to apply a piecewise affine transformation, and derive a face representation from a nine-layer deep neural network. This deep network involves more than 120 million parameters using several locally connected layers without weight sharing, rather than the standard convolutional layers. Thus we trained it on the largest facial dataset to-date, an identity labeled dataset of four million facial images belonging to more than 4,000 identities, where each identity has an average of over a thousand samples. The learned representations coupling the accurate model-based alignment with the large facial database generalize remarkably well to faces in unconstrained environments, even with a simple classifier. Our method reaches an accuracy of 97.25% on the Labeled Faces in the Wild (LFW) dataset, reducing the error of the current state of the art by more than 25%, closely approaching human-level performance.<sup>46</sup>

Facebook is a useful reminder that FR is neither a fad nor an anomaly.<sup>47</sup> FR is clearly here to stay, it's getting more and more powerful, and one way or another it will affect all of us.

We call on NTIA to demonstrate greater leadership to help fulfill President Obama's promise that consumer privacy is safeguarded. The NTIA must demonstrate it is committed to ensuring that sensitive data applications involving financial and health services, the use of racial and ethnic data, and where youth are targeted, are all properly assessed through robust analysis of FR-related practices. NGOs do not have the resources to engage in the comprehensive analysis this issue requires. NTIA should develop a "road map" that includes a robust and serious analysis of the commercial FR landscape, including the public policy implications, to guarantee consumer privacy and welfare.

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<sup>46</sup> Yaniv Taigman, Ming Yang, Marc'Aurelio Ranzato, Lior Wolf, "DeepFace: Closing the Gap to Human-Level Performance in Face Verification," abstract prepared for the Conference on Computer Vision and Pattern Recognition (CVPR), 2014, <https://www.facebook.com/publications/546316888800776/> (viewed 20 Mar. 2014).

<sup>47</sup> Lesley Stahl, "A Face in the Crowd: Say Goodbye to Anonymity," 60 Minutes, 19 May 2013, <http://www.cbsnews.com/videos/a-face-in-the-crowd-say-goodbye-to-anonymity-50147158/> (viewed 18 Mar. 2014).