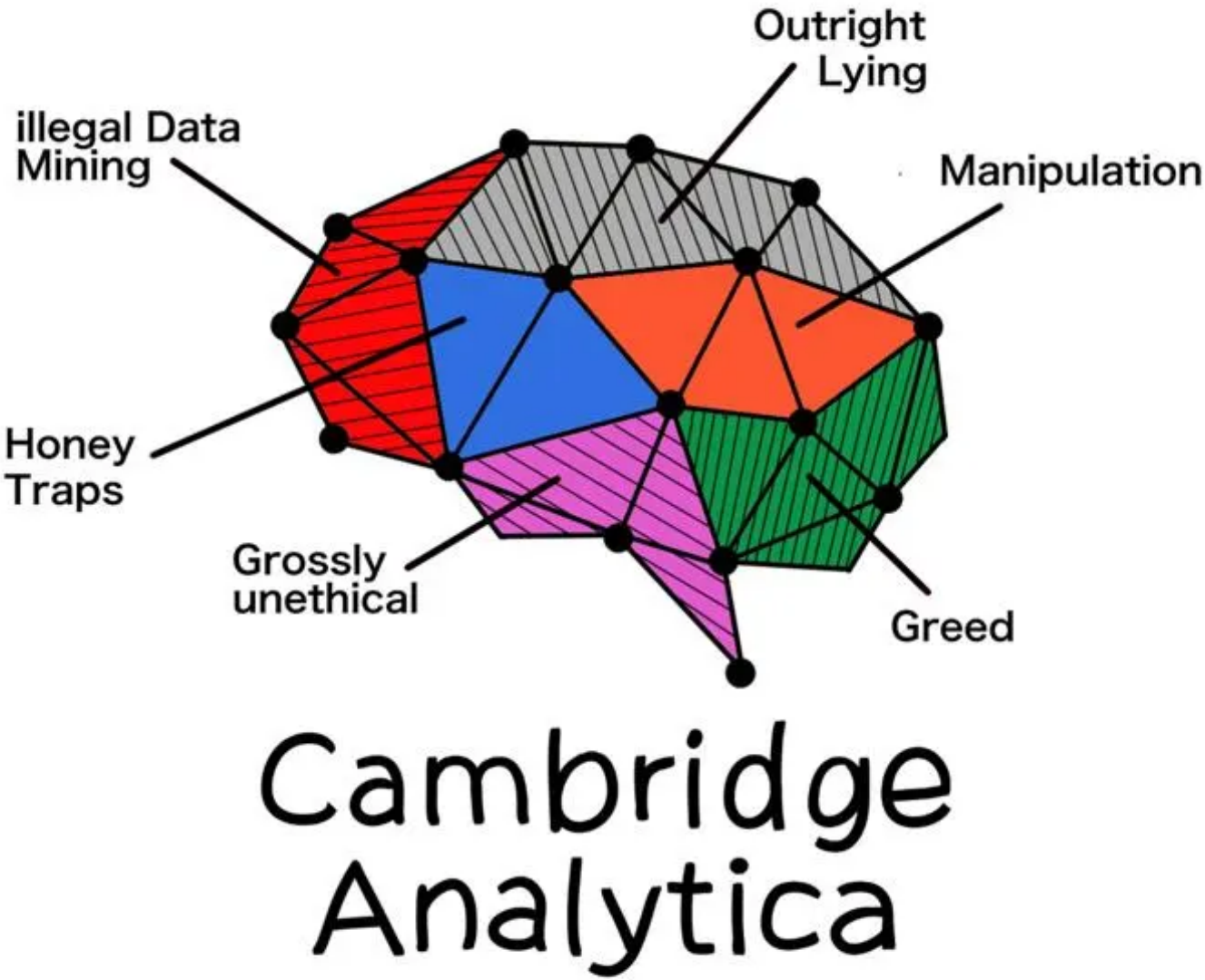
Human hacking & deepfake: manipolazione tramite social network e IA generativa

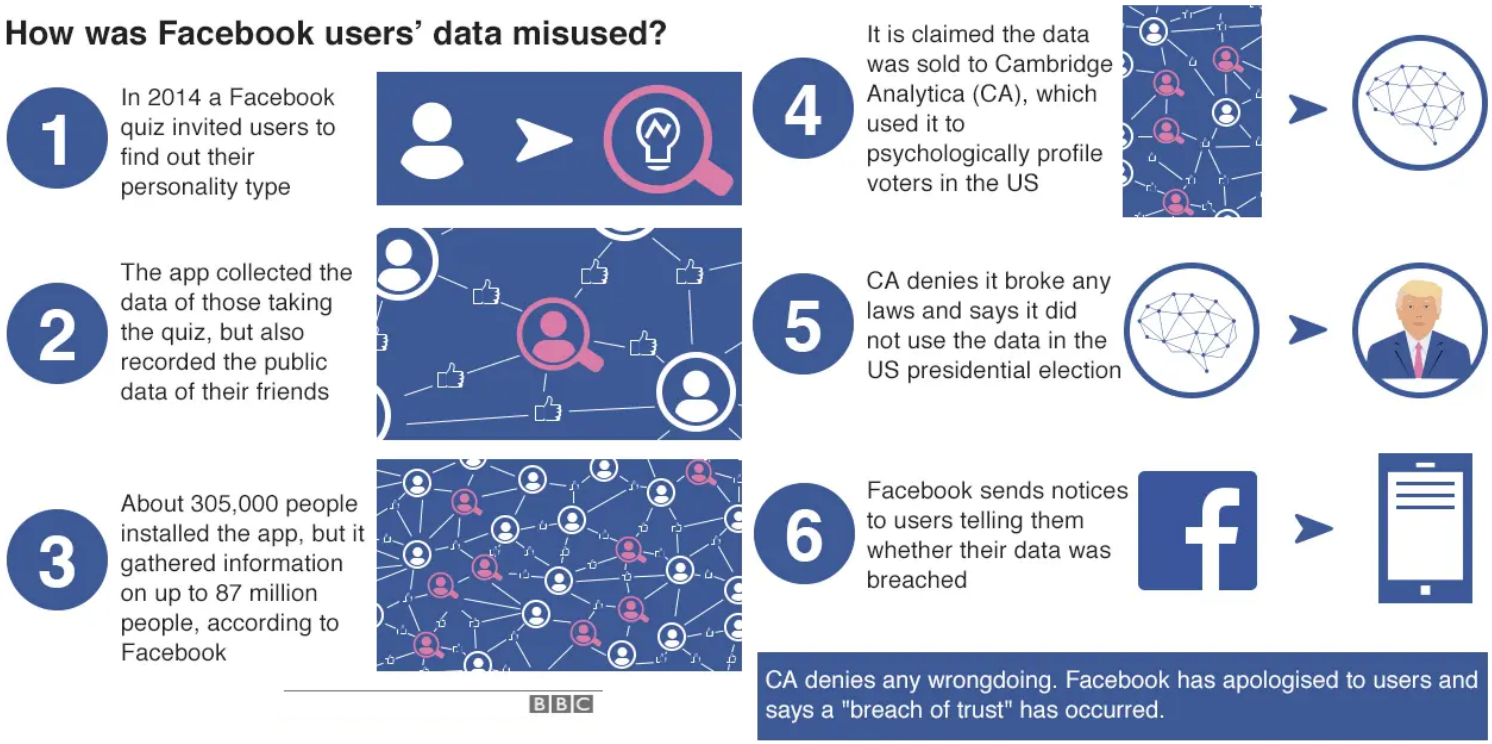
Outline

Motivazione

Cambridge Analytica [1]



Cambridge Analytica [2]



Cambridge Analytica [3]

Meta paga 725 milioni di dollari per risolvere class action Cambridge Analytica

TELEBORSA

Pubblicato il 23/12/2022
Ultima modifica il 23/12/2022 alle ore 13:03

Meta Platforms (società che controlla Facebook, Instagram e WhatsApp) ha **accettato di pagare 725 milioni di dollari per risolvere una class action** che accusava il colosso dei social media di consentire a terzi, tra cui Cambridge Analytica, di accedere alle informazioni personali degli utenti. La società fondata da Mark Zuckerberg **non ha ammesso alcun illecito** come parte dell'accordo, che è soggetto all'approvazione di un giudice federale di San Francisco, ma ha sottolineato che l'accordo è "nel migliore interesse della nostra comunità e degli azionisti".

Cambridge Analytica [4]

ANSA.it › Tecnologia › Internet & Social ›

Garante Privacy, multa 1 mln a Facebook per Cambridge Analytica

Garante Privacy, multa 1 mln a Facebook per Cambridge Analytica

Società attraverso app ha avuto accesso a dati 87 milioni di utenti

Redazione ANSA

28 giugno 2019
16:54
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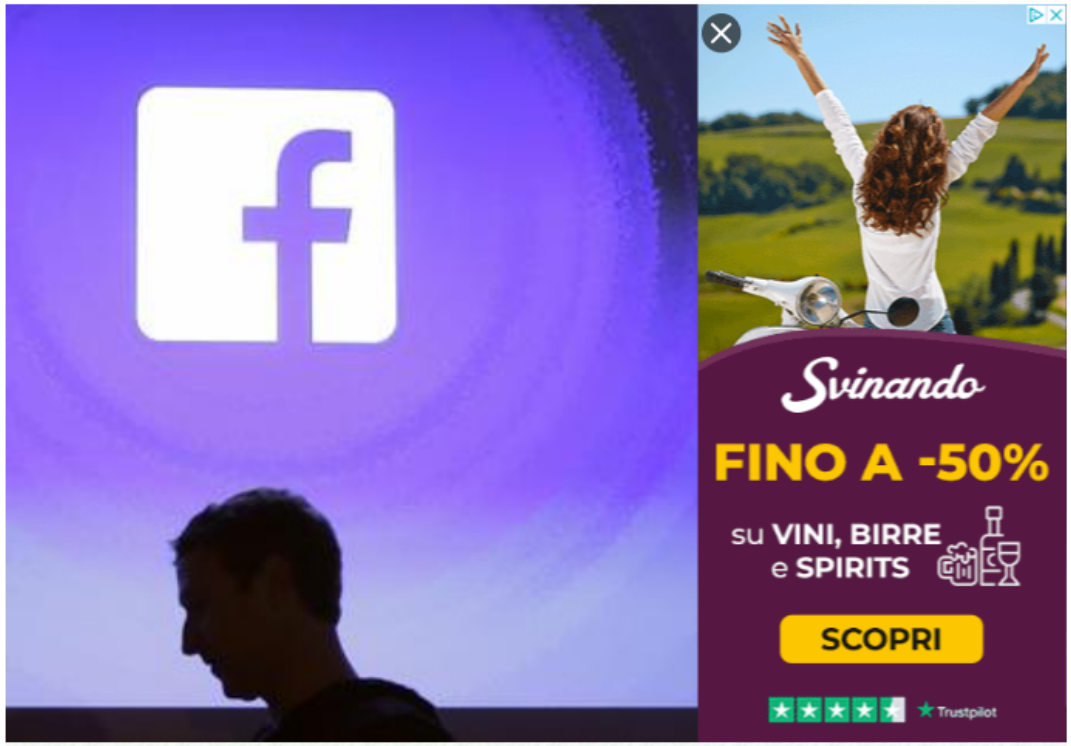


Garante Privacy, multa 1 mln a Facebook per Cambridge Analytica © ANSA/AP

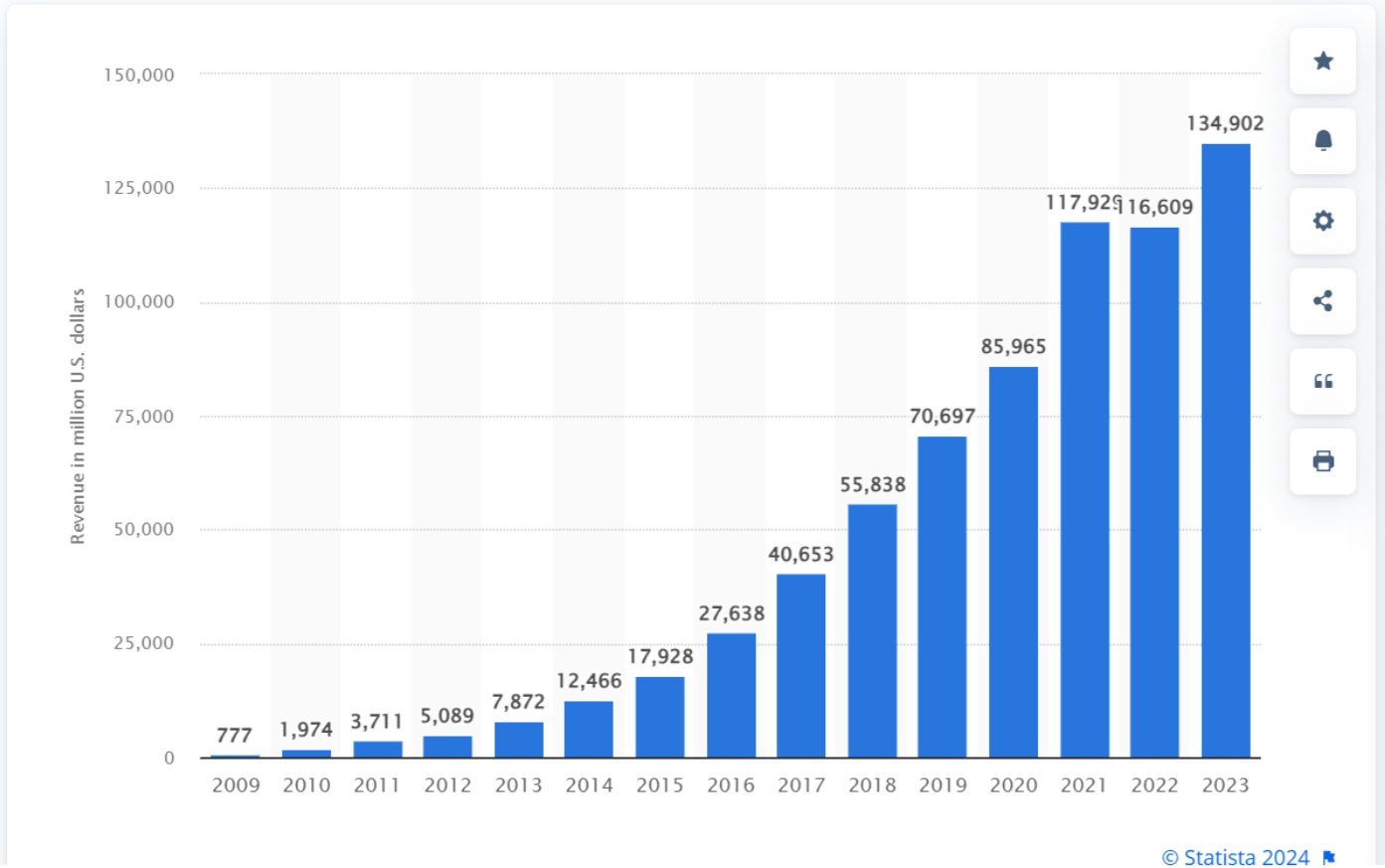
CLICCA PER INGRANDIRE

Cambridge Analytica [5]

Internet › Social Media & User-Generated Content

Annual revenue generated by Meta Platforms from 2009 to 2023

(in million U.S. dollars)

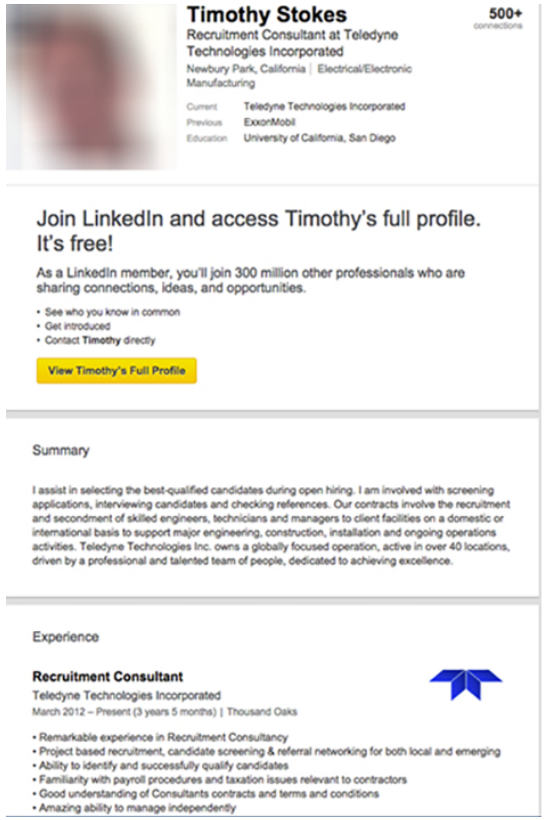


Mia Ash


Mia Ash
Timeline
About
Friends
Photos


Mia Ash
Photographer at Mia's Photography
London, Greater London, United Kingdom | Photography
500+
connections
Current Mia's Photography
Previous Loft Studios, Clapham Studios
Education Goldsmiths, University of London

Mia Ash [6]



Timothy Stokes
Recruitment Consultant at Teledyne Technologies Incorporated
Newbury Park, California | Electrical/Electronic Manufacturing
500+ connections

Current: Teledyne Technologies Incorporated
Previous: ExxonMobil
Education: University of California, San Diego

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- See who you know in common
- Get introduced
- Contact **Timothy** directly

View Timothy's Full Profile

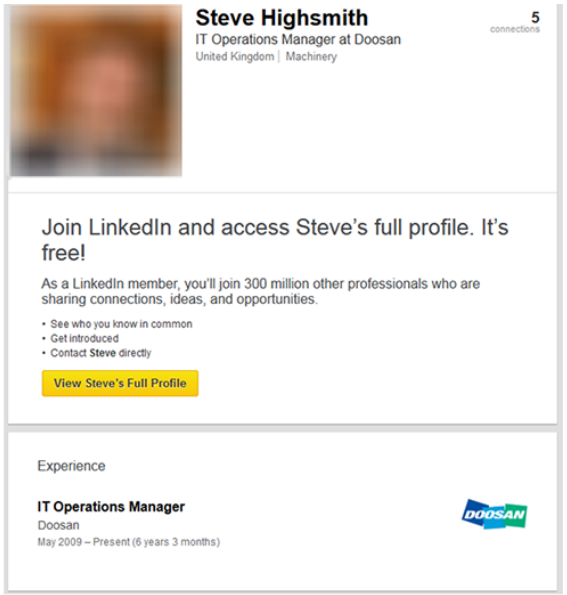
Summary

I assist in selecting the best-qualified candidates during open hiring. I am involved with screening applications, interviewing candidates and checking references. Our contracts involve the recruitment and secondment of skilled engineers, technicians and managers to client facilities on a domestic or international basis to support major engineering, construction, installation and ongoing operations activities. Teledyne Technologies Inc. owns a globally focused operation, active in over 40 locations, driven by a professional and talented team of people, dedicated to achieving excellence.

Experience

Recruitment Consultant
Teledyne Technologies Incorporated
March 2012 – Present (3 years 5 months) | Thousand Oaks

- Remarkable experience in Recruitment Consultancy
- Project based recruitment, candidate screening & referral networking for both local and emerging
- Ability to identify and successfully qualify candidates
- Familiarity with payroll procedures and taxation issues relevant to contractors
- Good understanding of Consultants contracts and terms and conditions
- Amazing ability to manage independently



Steve Highsmith
IT Operations Manager at Doosan
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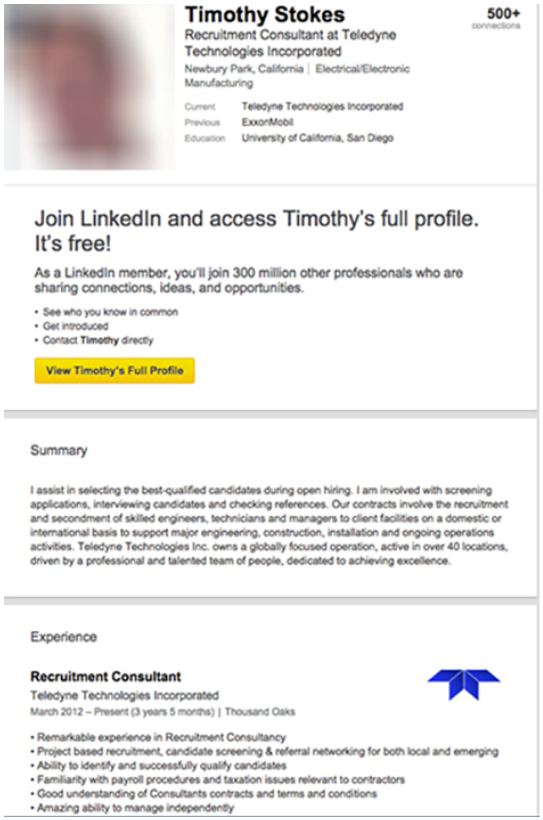
Experience

IT Operations Manager
Doosan
May 2009 – Present (6 years 3 months)

Mia Ash [6]



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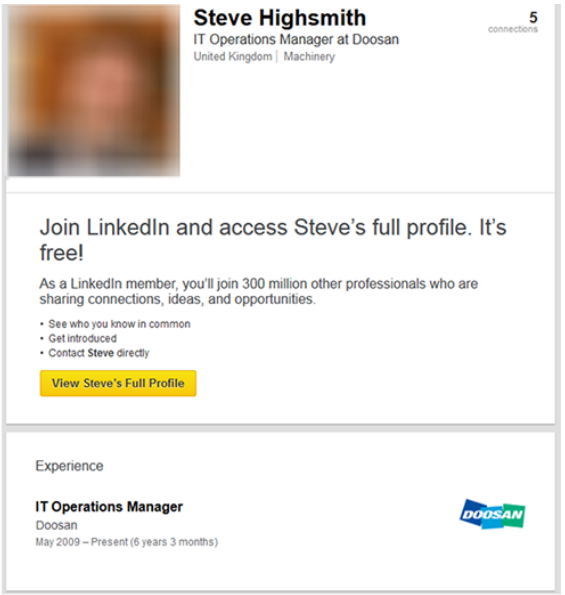

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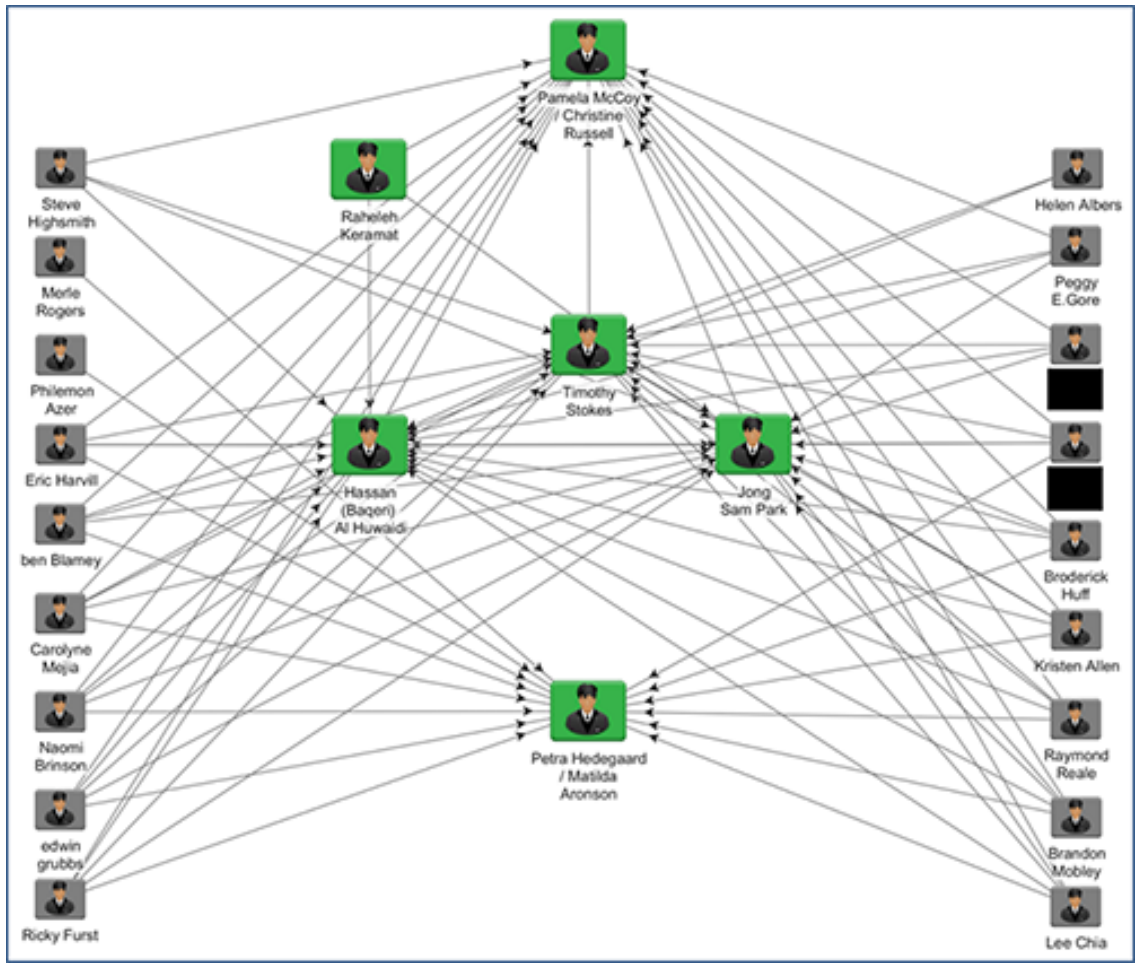
Mia Ash [6]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Carolyne Mejia
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edwin grubbs
Ricky Furst
Helen Albers
Peggy E.Gore
Broderick Huff
Kristen Allen
Raymond Reale
Brandon Mobley
Lee Chia

Mia Ash [7]

Exclusive ne

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Technology

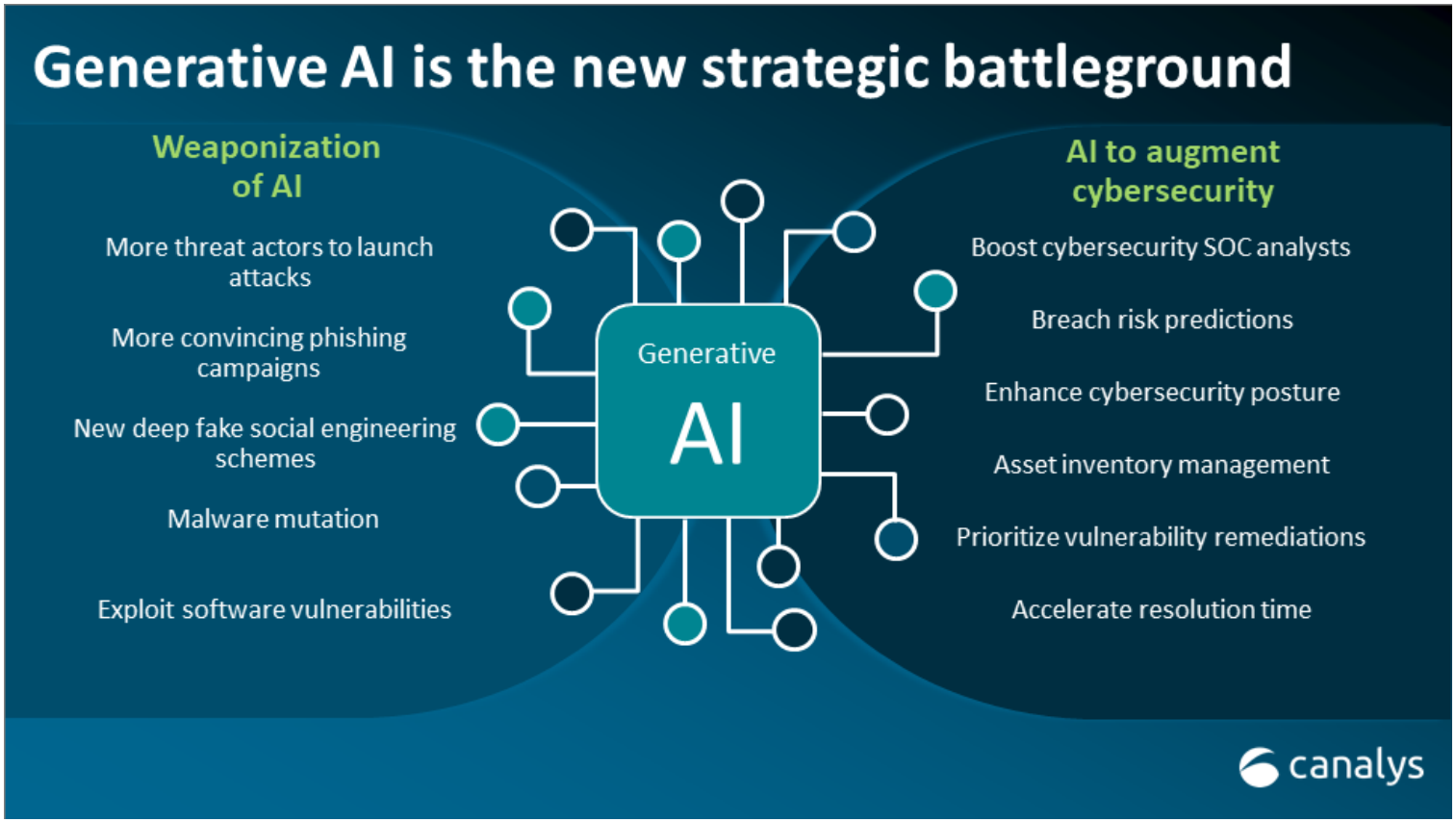
Iranian hackers used female 'honey pot' to lure targets: researchers

By **Dustin Volz**

July 27, 2017 4:32 PM GMT+2 · Updated 7 years ago

Aa

IA generativa per il phishing [8]



IA generativa per il phishing [9]

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Artificial intelligence (AI)

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AI will make scam emails look genuine, UK cybersecurity agency warns

NCSC says generative AI tools will soon allow amateur cybercriminals to launch sophisticated phishing attacks

Dan Milmo

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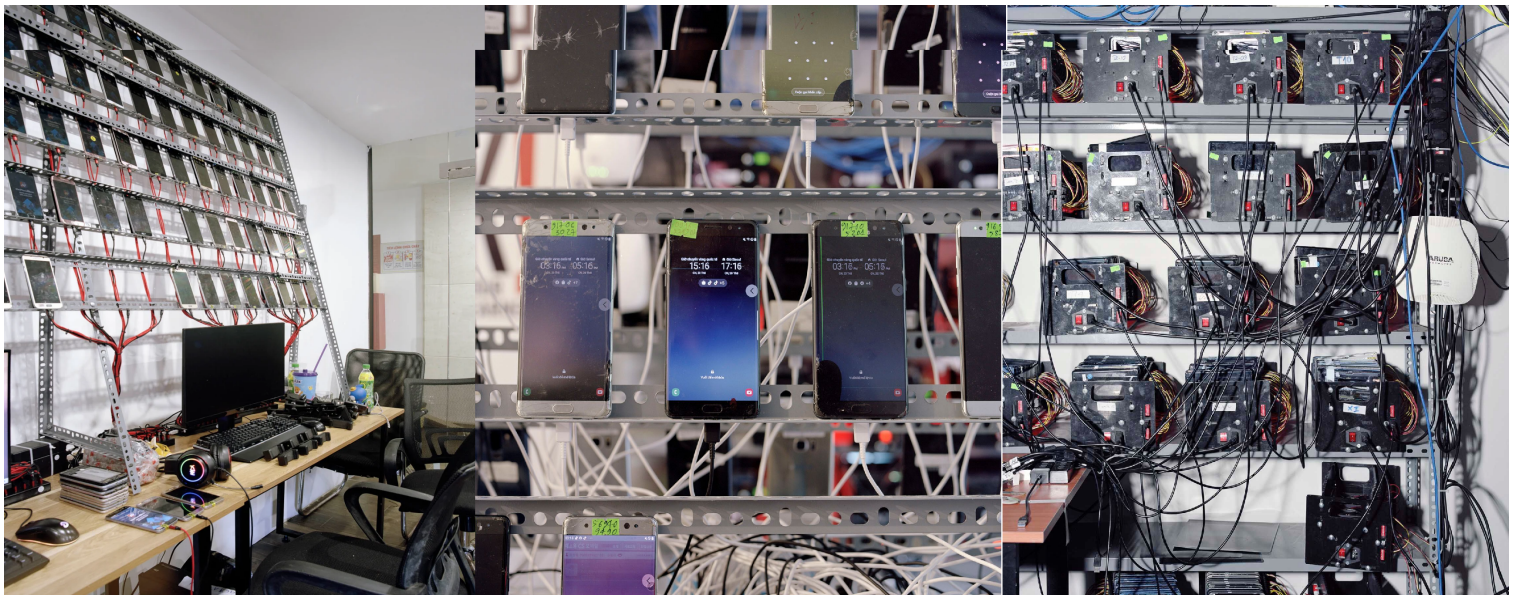

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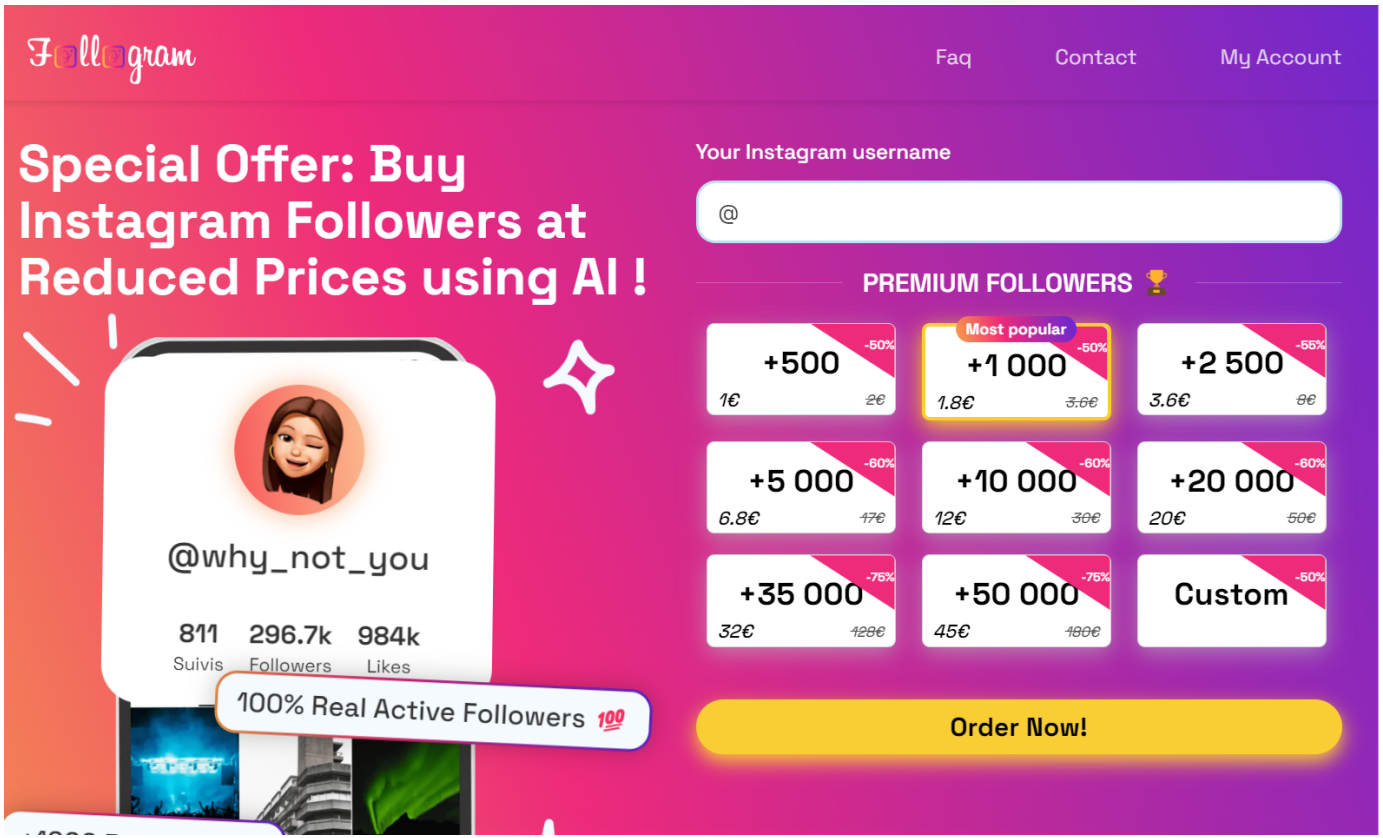
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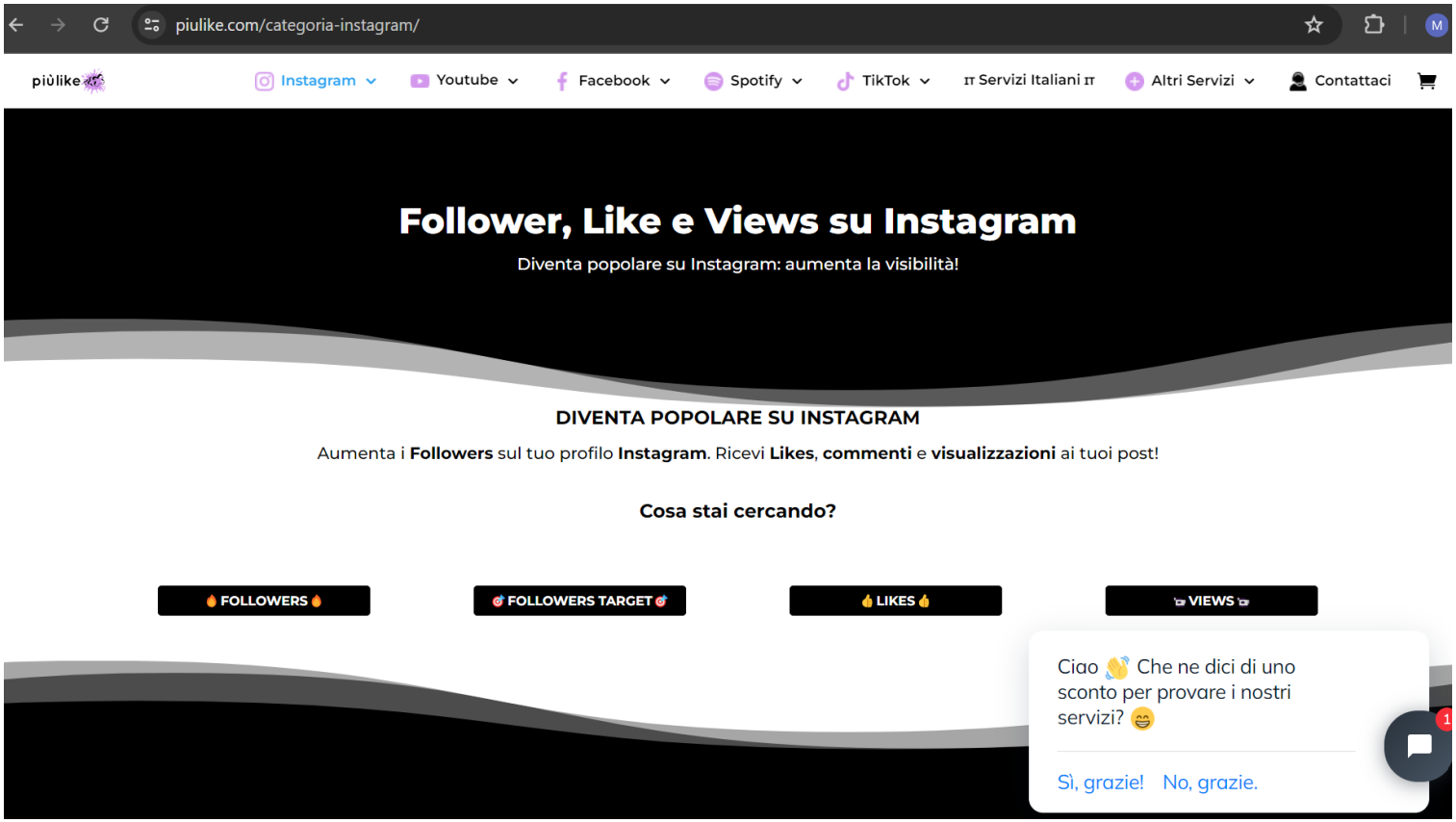
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DIVENTA POPOLARE SU INSTAGRAM
Aumenta i Followers sul tuo profilo Instagram. Ricevi Likes, commenti e visualizzazioni ai tuoi post!
Cosa stai cercando?
FOLLOWERS
FOLLOWERS TARGET
LIKES
VIEWS
Ciao Che ne dici di uno sconto per provare i nostri servizi?
Sì, grazie!
No, grazie.

Click Farm [11]

Social Media Influencers and the 2020 U.S. Election: Paying 'Regular People' for Digital Campaign Communication

Manipolazione dei sistemi democratici

Politica e nano-influencer [11]

"Coordinated networks of social media influencers, especially small-scale influencers with fewer than 10,000 followers, are now a powerful asset for political campaigns, PACs, and special interest groups. Partisan organizations are leveraging these "authentic" accounts in bids to sway political discourse and decision-making in the run up to the 2020 U.S. elections. Political marketers tell us that they see influencers, particularly those with more intimate followings, as regarded as more trustworthy by their followers and therefore better positioned to change their behavior"

Definizioni

Deefake e Intelligenza Artificiale - definizioni

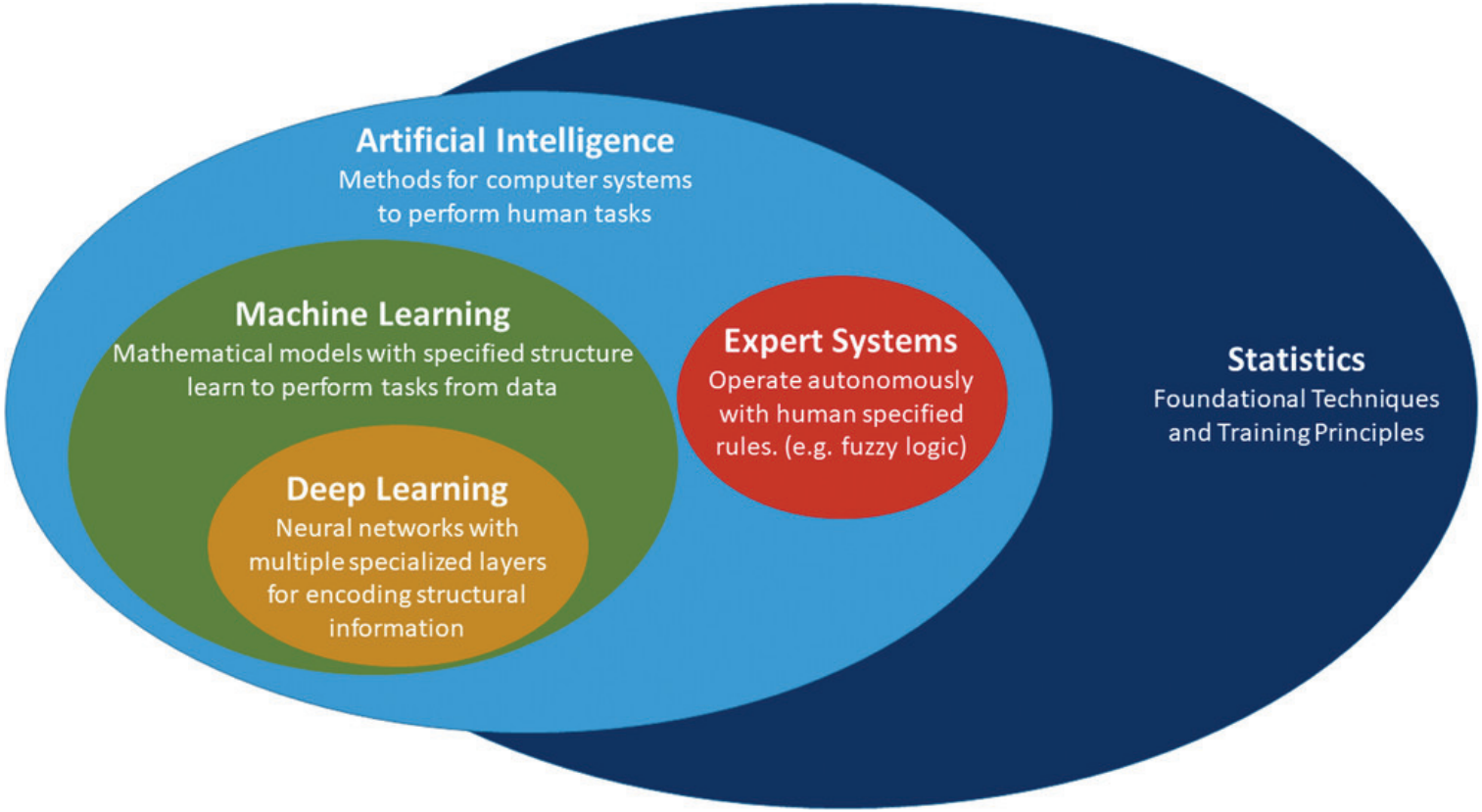
Deepfake (NSA) [12]

Contenuto multimediale creato sinteticamente o manipolato utilizzando una qualche forma di tecnologia meccanica o di deep learning.

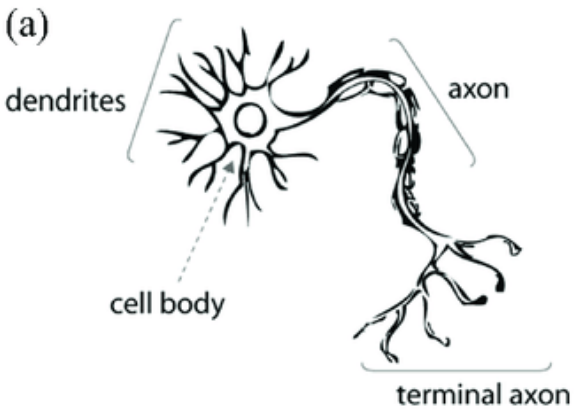
Intelligenza artificiale (NIST) [13]

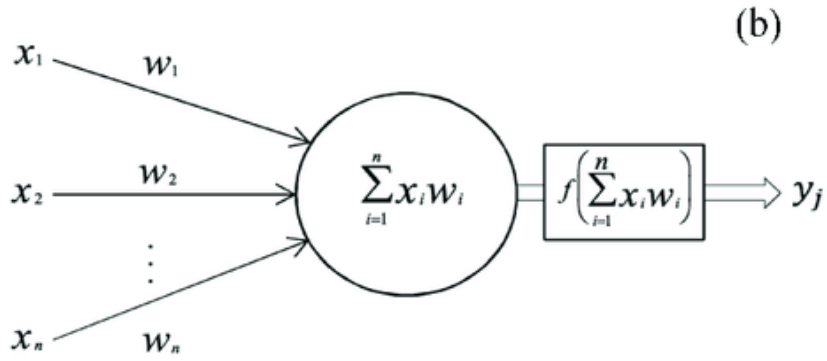
Una branca dell'informatica dedicata allo sviluppo di sistemi di elaborazione dati che svolgono funzioni normalmente associate all'intelligenza umana, come il ragionamento, l'apprendimento e l'auto-miglioramento

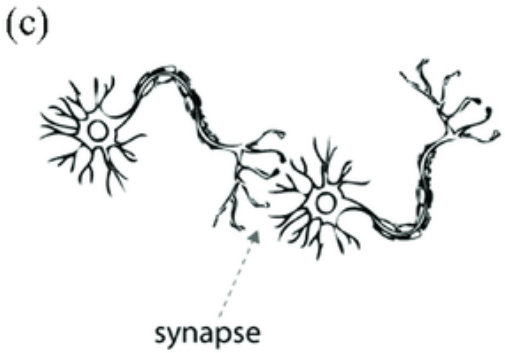
Deepfake e Intelligenza Artificiale - tassonomia [14]

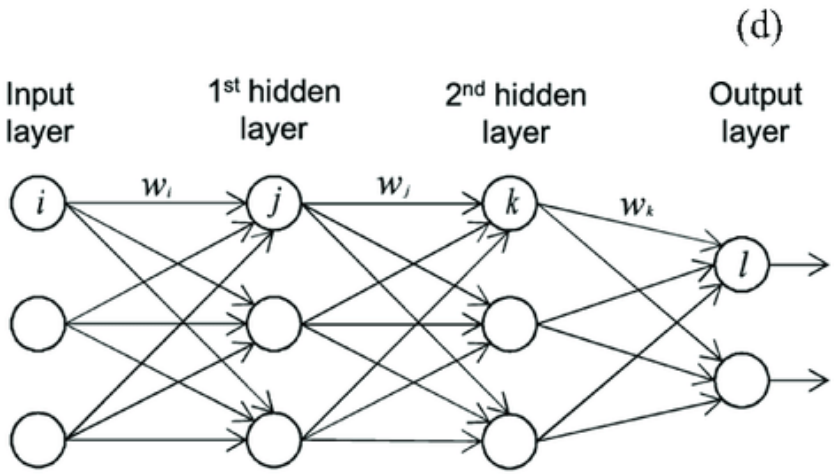


Deepfake e Intelligenza Artificiale - reti neurali [15]



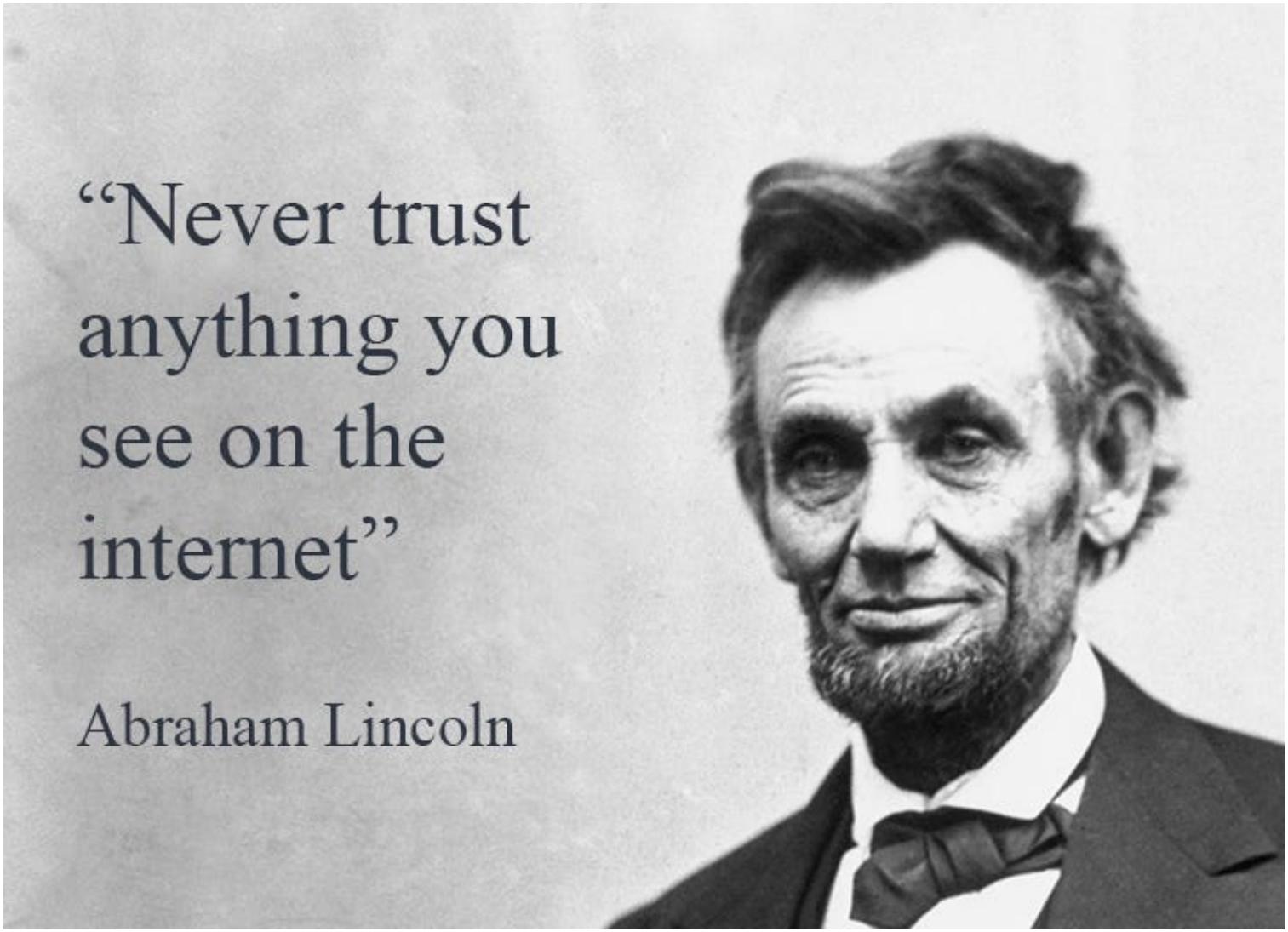






Breve storia

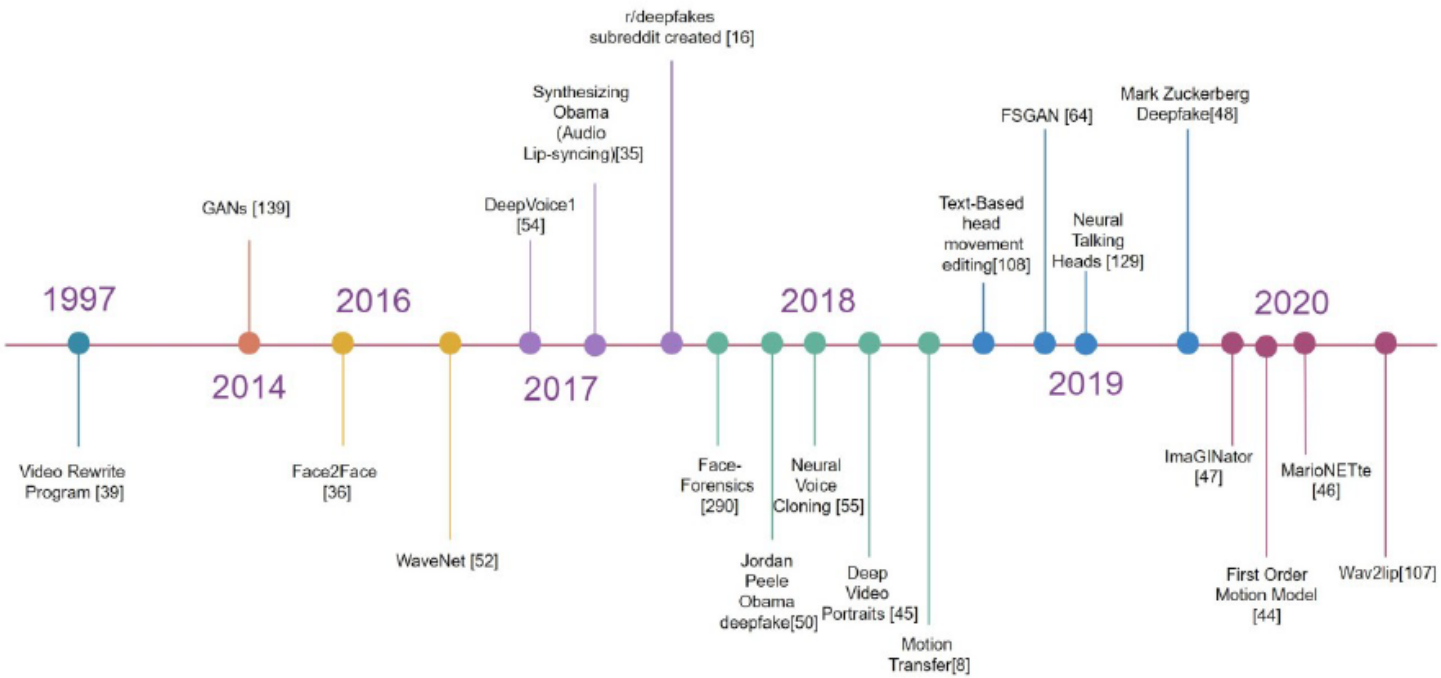
Storia dei deepfake



Storia dei deepfake: 1860 Calhoun/Lincon [16]

Storia dei deepfake: 1997 Video Rewrite (GAN) [17]

Deepfake e Intelligenza Artificiale - tassonomia [27]



Storia dei deepfake: 2017 B.Obama [18]

Technology

This article is more than 6 years old

The future of fake news: don't believe everything you read, see or hear

A new breed of video and audio manipulation tools allow for the creation of realistic looking news footage, like the now infamous fake Obama speech

Olivia Solon *in San Francisco*

Wed 26 Jul 2017 07.00 CEST

The University of Washington's Synthesizing Obama project took audio from one of Obama's speeches and used it to animate his face in an entirely different video

Storia dei deepfake: 2017 Imitazione della voce [19]

WSJ PRO

Fraudsters Used AI to Mimic CEO's Voice in Unusual Cybercrime Case

Scams using artificial intelligence are a new challenge for companies

By Catherine Stupp

Updated Aug. 30, 2019 12:52 pm ET | WSJ PRO

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PHOTO: SIMON DAWSON/BLOOMBERG NEWS

Criminals used artificial intelligence-based software to impersonate a chief executive's voice and demand a fraudulent transfer of €220,000 ($243,000) in March in what cybercrime experts described as an unusual case of artificial intelligence being used in hacking.

The CEO of a U.K.-based energy firm thought he was speaking on the phone with his boss, the chief executive of the firm's German parent company, who asked him

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1. Port of Rotterdam Tests Quantum Network to Defend Against Hacks

2. Okta Hack Update

Storia dei deepfake: 2020 N.Pelosi [19]

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World

Fact check: "Drunk" Nancy Pelosi video is manipulated

By **Reuters**

August 3, 2020 7:23 PM GMT+2 · Updated 4 years ago

Aa

U.S. Speaker of the House Nancy Pelosi, joined by Senate Minority Leader Chuck Schumer, speaks to reporters in the U.S. Capitol in Washington, U.S. July 29, 2020. REUTERS/Erin Scott *Purchase Licensing Rights*

A video circulating on social media shows House Speaker Nancy Pelosi speaking in a slurred and awkward manner. One popular post boasts 91,000 shares on Facebook and bears a caption reading: "This is unbelievable, she is blowed out of her mind, I bet this gets taken down!" The video, however, has been manipulated to make Pelosi appear drunk and incoherent.

A viral example of the video is visible here .

Storia dei deepfake: Software disponibili [27]

Tool	Type	Reference/Developer	Technique
Cheap fakes			
Adobe Premiere	Commercial Desktop Software	Adobe	Audio Video Editing, AI-powered video reframing
Corel VideoStudio	Commercial Desktop Software	Corel	Proprietary AI
Lip-sync			
dynalips	Commercial Web App	www.dynalips.com/	Proprietary
crazytalk	Commercial Web App	www.reallusion.com/crazytalk/	Proprietary
Wav2Lip	Open source implementation	github.com/Rudrabha/Wav2Lip	GAN with pre-trained discriminator network and visual quality loss function
Facial Attribute Manipulation			
FaceApp	MobileApp	FaceApp Inc	Deep generative CNNs
Adobe	Commercial Desktop Software	Adobe	DNNs + filters
Rosebud	Commercial Web App	www.rosebud.ai/	Proprietary AI
Face Swap			
ZAO	Mobile app	Momo Inc	Proprietary
REFACE	Mobile app	Neocortext, Inc	Proprietary
Reflect	Mobile app	Neocortext, Inc	Proprietary
Impressions	Mobile app	Synthesized Media, Inc.	Proprietary
FakeApp	Desktop App	www.malavida.com/en/soft/fakeapp/	GAN
FaceSwap	Open source implementation	faceswapweb.com/	Employed two pairs of encoder-decoder. Shared encoder parameters.
DFaker	Open source implementation	github.com/dfaker/df	For face reconstruction DSSIM loss function [34] is utilized. Keras library-based implementation.
DeepFaceLab	Open source implementation	github.com/iperov/DeepFaceLab	- provide several face extraction methods, e.g. dlib, MTCNN, S3FD etc. - Extend different Faceswap model i.e. H64, H128, LIAEF128, SAE [33].
FaceSwapGAN	Open source implementation	github.com/shaoanlu/faceswap-GAN	Uses two loss functions namely adversarial loss and perceptual loss to the auto-encoder.
DeepFake-tf	Open source implementation	github.com/StromWine/DeepFake-tf	Same as DFaker however, used tensor-flow for implementation.
Faceswapweb	Commercial Web App	faceswapweb.com/	GAN
Face Reenactment			
Face2Face	Open source implementation	web.stanford.edu/~zollhoef/papers/CVPR2016_Face2Face/page.html	Uses 3DMM and ML technique
Dynamixyz	Commercial Desktop Software	www.dynamixyz.com/	Machine-learning
FaceIT3	Open source implementation	github.com/alew3/faceit_live3	GAN
Face Generation			
Generated Photos	Commercial Web App	generated.photos/	StyleGAN
Voice Synthesis			
Overdub	Commercial Web App	www.descript.com/overdub	Proprietary (AI based)
Respeecher	Commercial Web App	www.respeecher.com/	Combined traditional digital signal processing algorithms with proprietary deep generative modeling techniques
SV2TTS	Open source implementation	github.com/CorentinJ/Real-Time-Voice-Cloning	LSTM with Generalized end-to-end loss
ResembleAI	Commercial Web App	www.resemble.ai/	Proprietary (AI based)
Voicery	Commercial Web App	www.voicery.com/	Proprietary AI and deep learning
VoiceApp	Mobile app	Zoezi AB	Proprietary (AI-based)

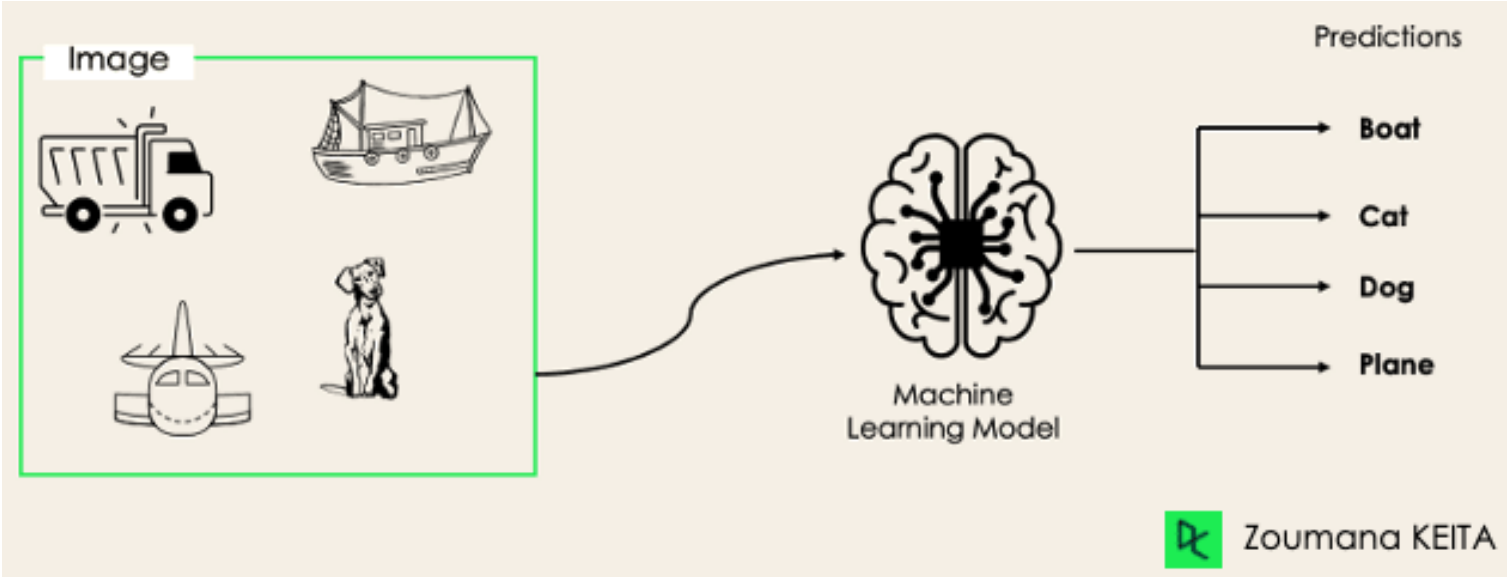
Fondamenti teorici/computazionali

Machine learning [29, 28, 20]

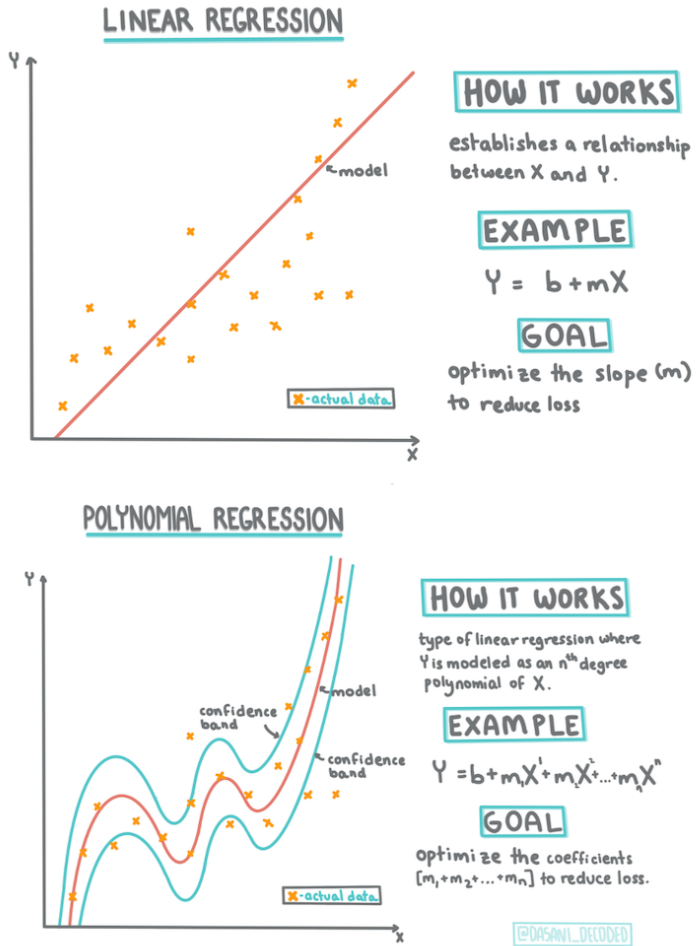
Distribuzione di probabilità condizionata - idea

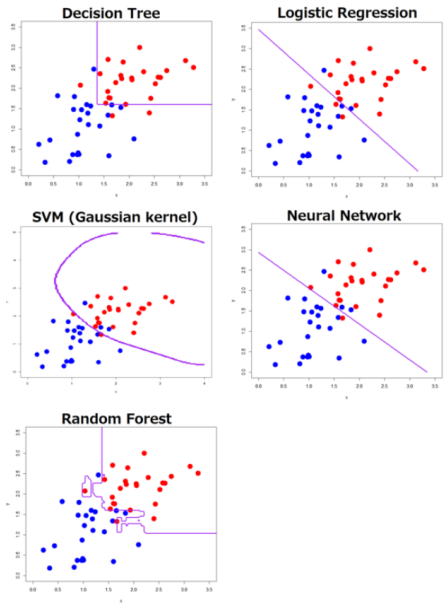
Abbiamo una serie di record che contengono delle variabili input (dimensione del fiore, colore etc..) e una variabile di output (caso semplice, può essere generalizzato). Non sappiamo a priori come input e output siano legati (altrimenti avremmo risolto il problema !), ma siamo interessati a trovare una funzione di probabilità che associ degli input a degli output. $p(y = c|\mathbf{x}; \theta) = f_c(\mathbf{x}; \theta)$

Machine learning [29, 28, 20]



Machine learning [29, 28, 21, 22]

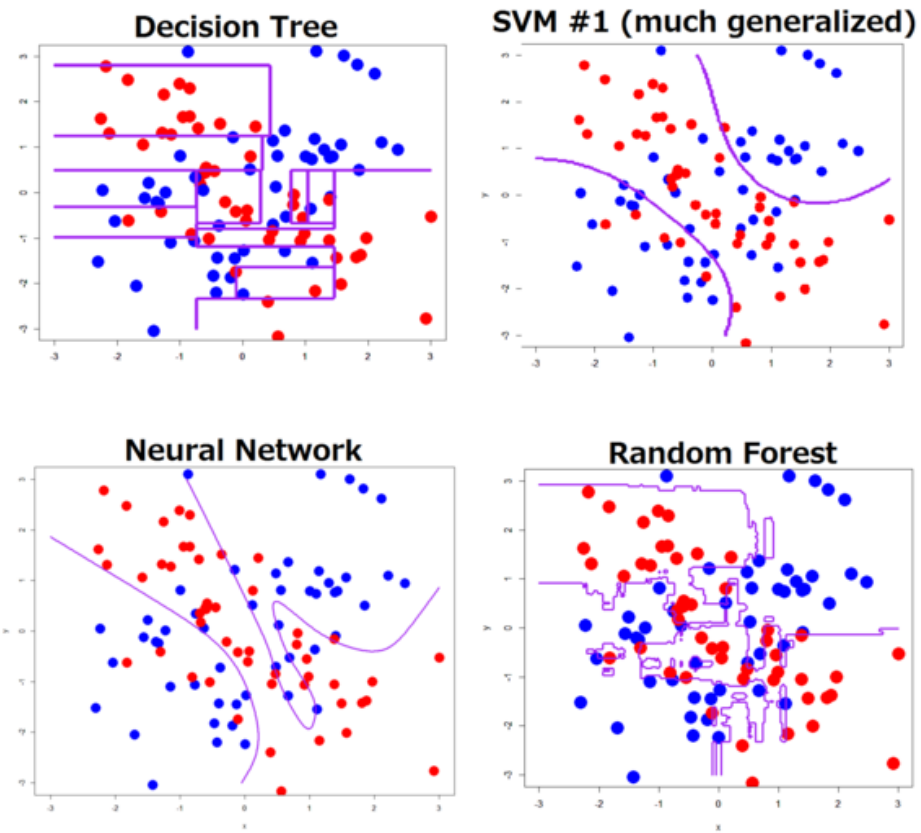




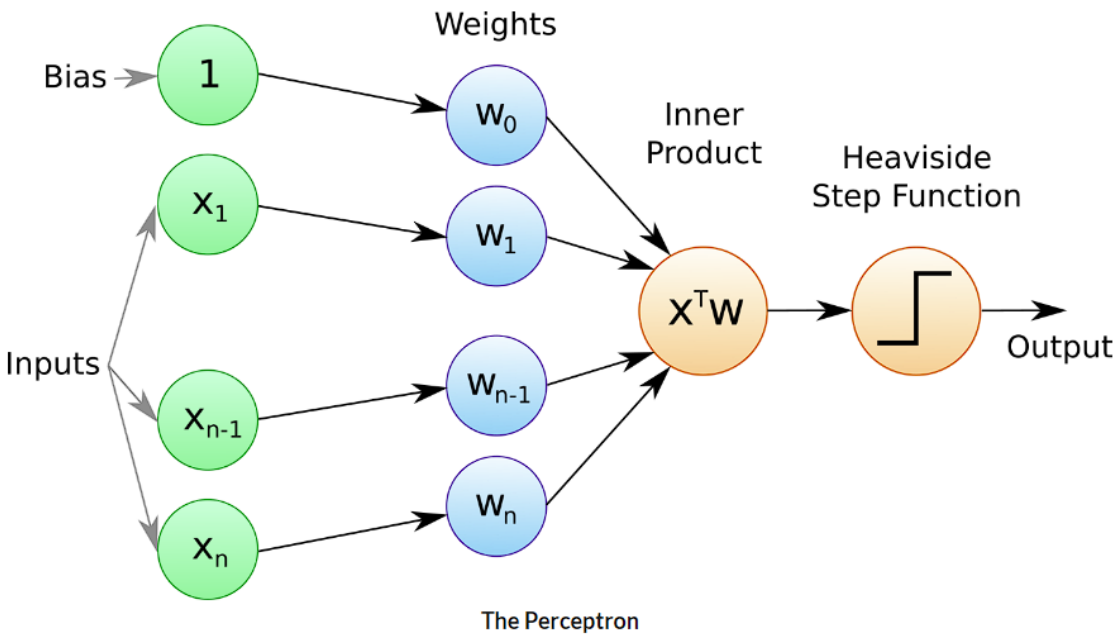
No free lunch theorem

Non esiste un modello che abbia performance migliori in tutti i casi possibili. Ciò è dovuto al fatto che ogni modello fa delle assunzioni.

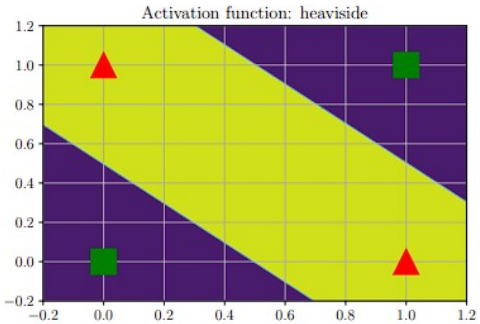
Machine learning [29, 28, 21, 22]

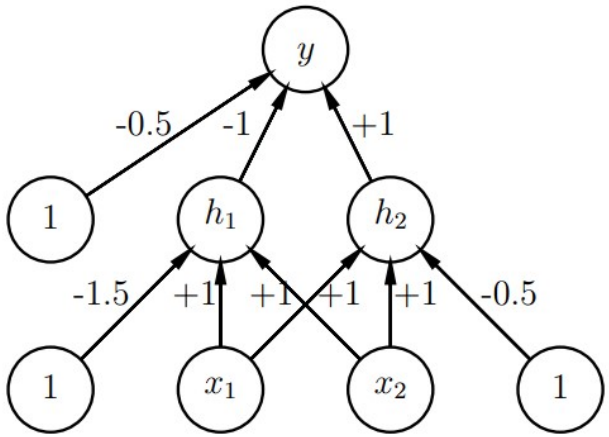


Reti neurali [29, 28]



The Perceptron

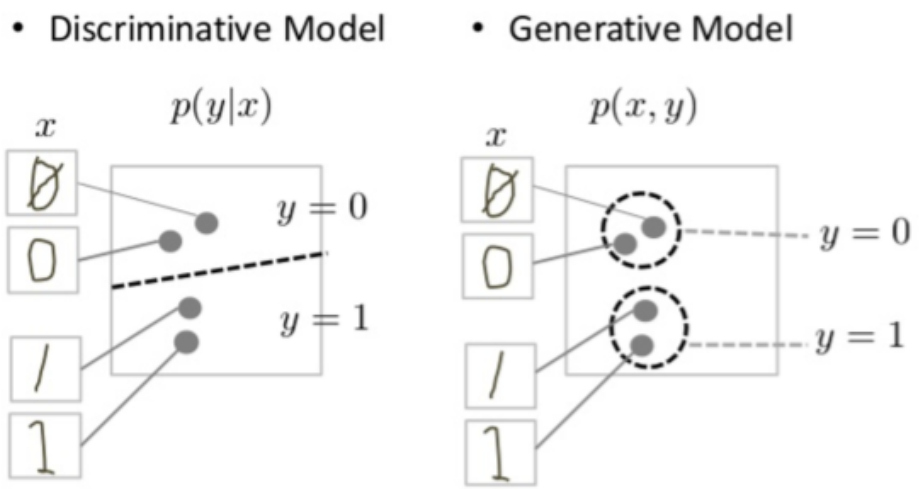




Modelli generativi [23, 29, 28]

Modello generativo

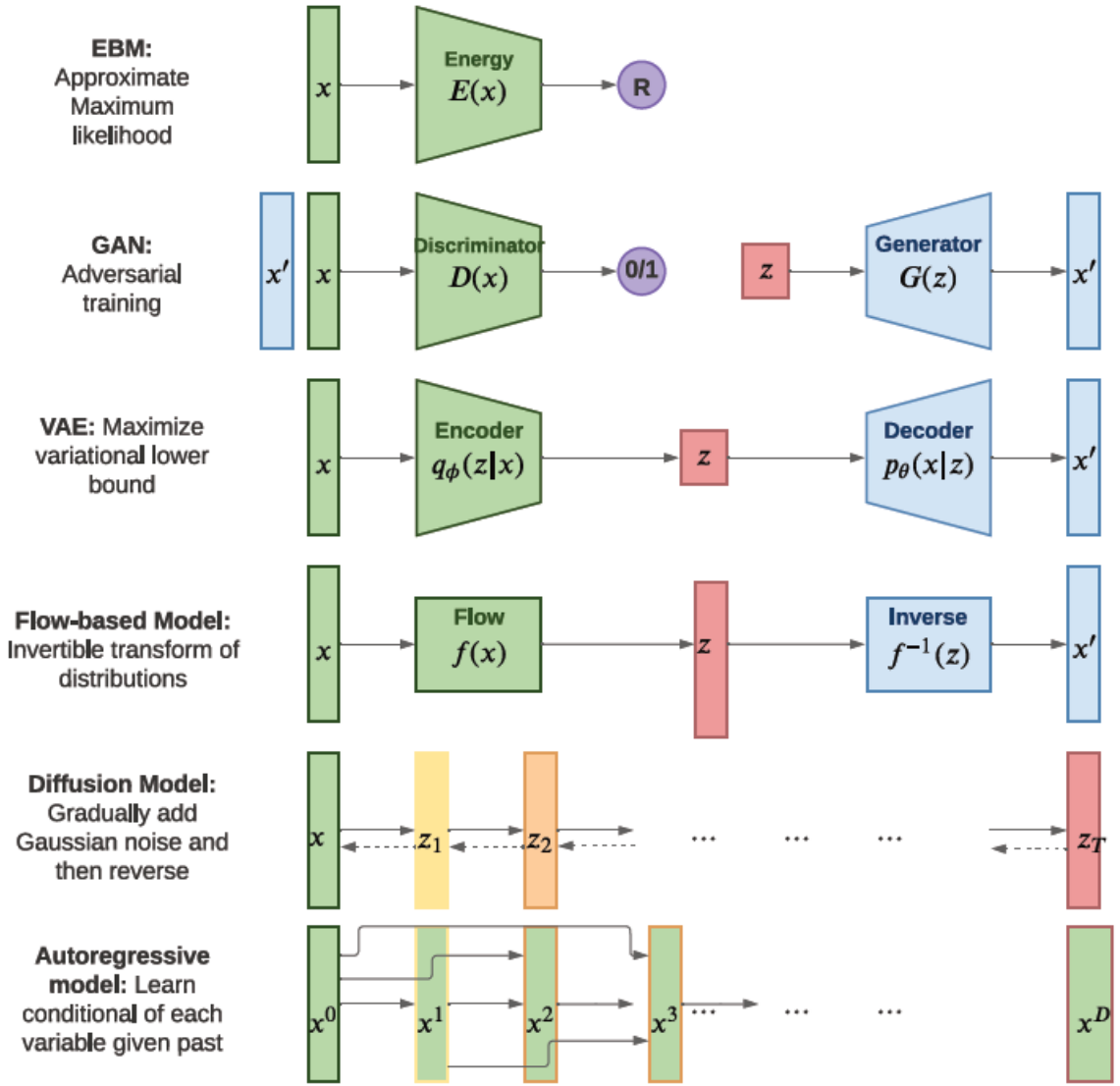
Un modello generativo descrive come viene generato un set di dati utilizzando un modello probabilistico ($p(x) \quad x \in X$). Campionando da questo modello, siamo in grado di generare nuovi dati.



Tipologia di modelli generativi

- Deep generative models (DGM): viene usata una deep neural network. Comprende i Variational Autoencoder (VAE) e le Generative adversarial network oltre che, ad esempio, i Diffusion models e gli Energy based models (EBM)
- Probabilistic graphical models: viene usato un grafo causale

Modelli generativi [29, 28]



Modelli generativi: esempi [29, 28]

Autoencoders [29, 28]

Autoencoder

Encoder (f_e) + Decoder f_d

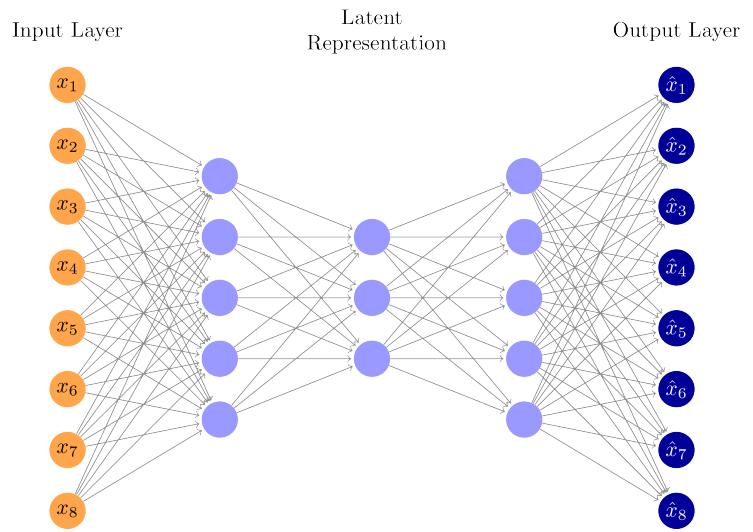
$f_e : x \rightarrow z$ $f_d : z \rightarrow x$

$r(x) = f_d(f_e(x))$ (rec. function)

$\mathcal{L}(\theta) = \|r(x) - x\|^2$ (loss function)

Funzionamento

L'unità in mezzo agisce come collo di bottiglia tra l'input e la sua ricostruzione, in modo da applicare una compressione.



Autoencoders [29]

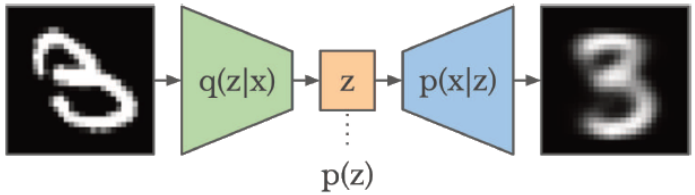
Variational autoencoders [29, 28]

Modello generativo

Un modello generativo descrive come viene generato un set di dati utilizzando un modello probabilistico ($p(x) \quad x \in X$). Campionando da questo modello, siamo in grado di generare nuovi dati.

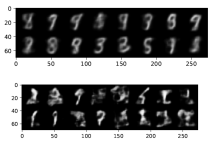
Differenza rispetto agli AE

Rispetto agli autoencoder i variational autoencoder possono essere visti come una versione probabilistica di un autoencoder deterministico. In questo modo si può avere una IA generativa



Remark

La VAE, per come è costruita, è in grado di convertire punti casuali in output, mentre il decoder di AE (deterministico) funziona solo per un punto che è già presente nel training.



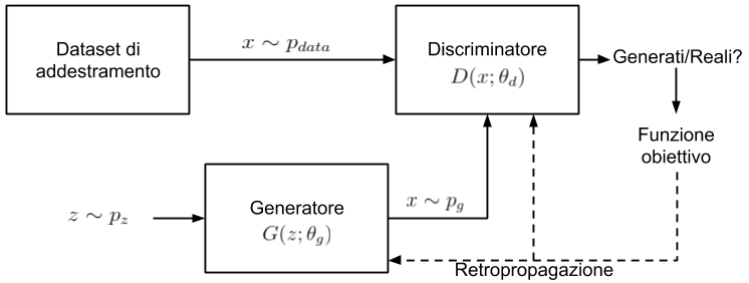
VAR generation [29, 28]

Generative adversarial networks [29, 28]

Idea

Ho due reti neurali

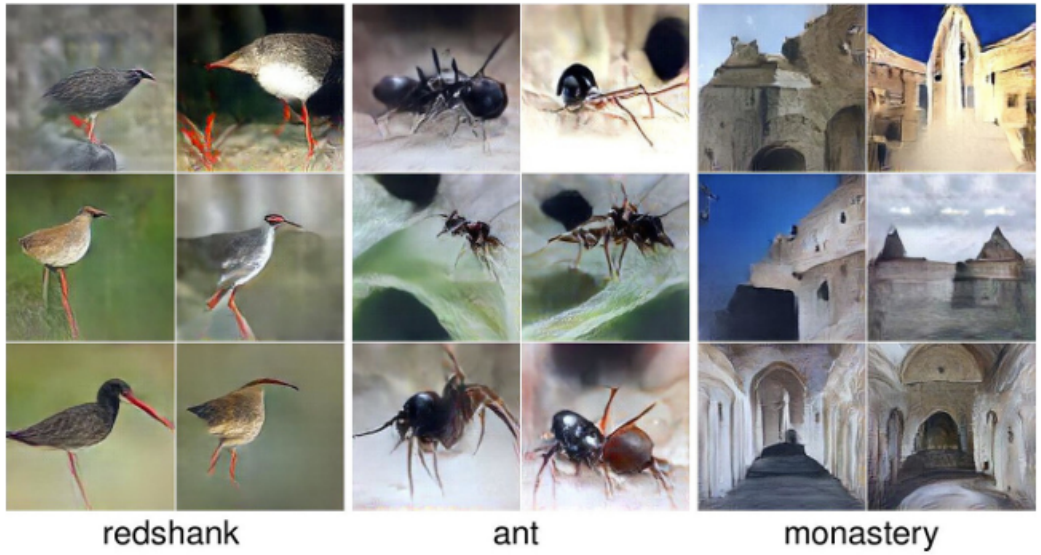
- Generatore: creare nuovi dati
- Discriminatore: distinguere i dati nuovi da quelli veri



Algorithm 26.2: GAN training algorithm

Initialize ϕ, $\boldsymbol{\theta}$
for *each training iteration* **do**
  for K *steps* **do**
    Sample minibatch of M noise vectors $\boldsymbol{z}_m \sim q(\boldsymbol{z})$
    Sample minibatch of M examples $\boldsymbol{x}_m \sim p^*(\boldsymbol{x})$
    Update the discriminator by performing stochastic gradient descent using this gradient:
    $\nabla_{\boldsymbol{\phi}} \frac{1}{M} \sum_{m=1}^{M} [g(D_{\boldsymbol{\phi}}(\boldsymbol{x}_m)) + \nabla_{\boldsymbol{\phi}} h(D_{\boldsymbol{\phi}}(G_{\boldsymbol{\theta}}(\boldsymbol{z}_m)))]$.
  Sample minibatch of M noise vectors $\boldsymbol{z}_m \sim q(\boldsymbol{z})$
  Update the generator by performing stochastic gradient descent using this gradient:
  $\nabla_{\boldsymbol{\theta}} \frac{1}{M} \sum_{m=1}^{M} l(D_{\boldsymbol{\phi}}(G_{\boldsymbol{\theta}}(\boldsymbol{z}_m)))$.
Return $\boldsymbol{\phi}$, $\boldsymbol{\theta}$

VAR generation [30]



Difesa: come rilevarle ?

Metodi [27]

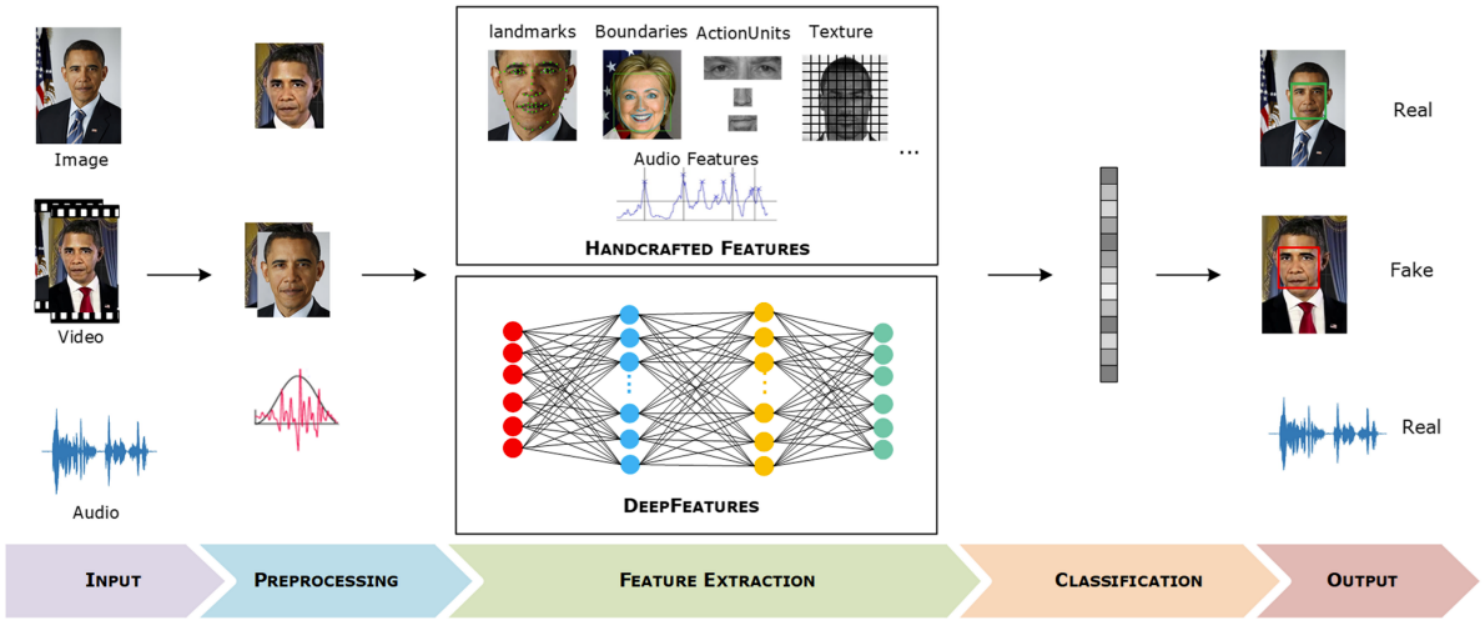
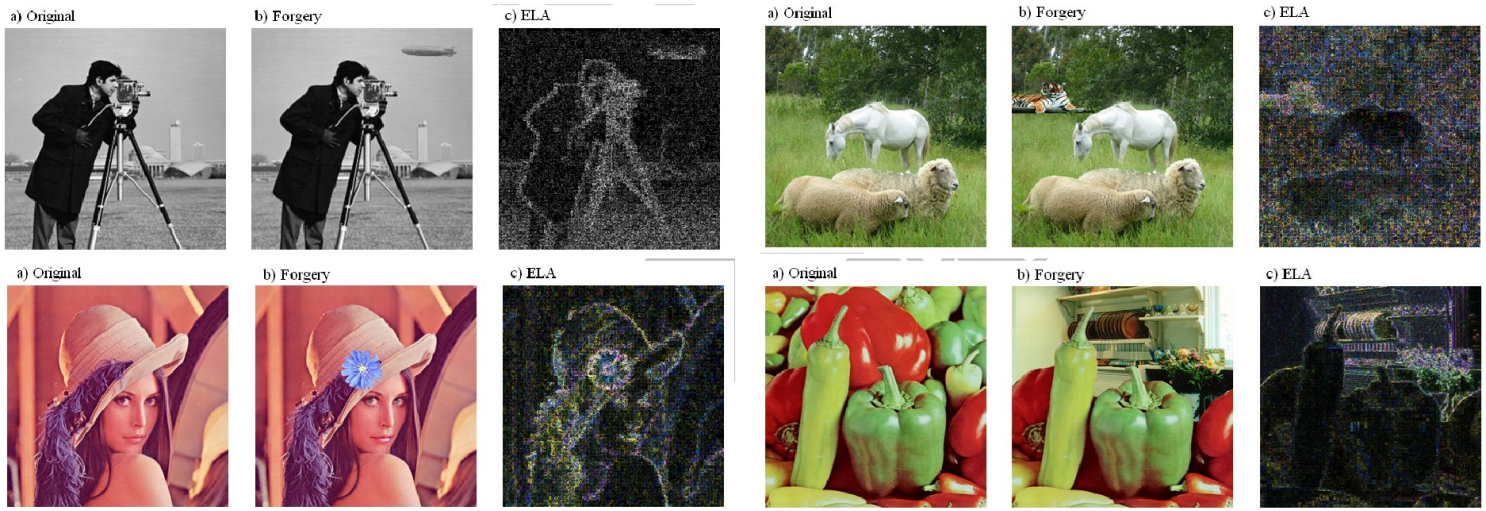
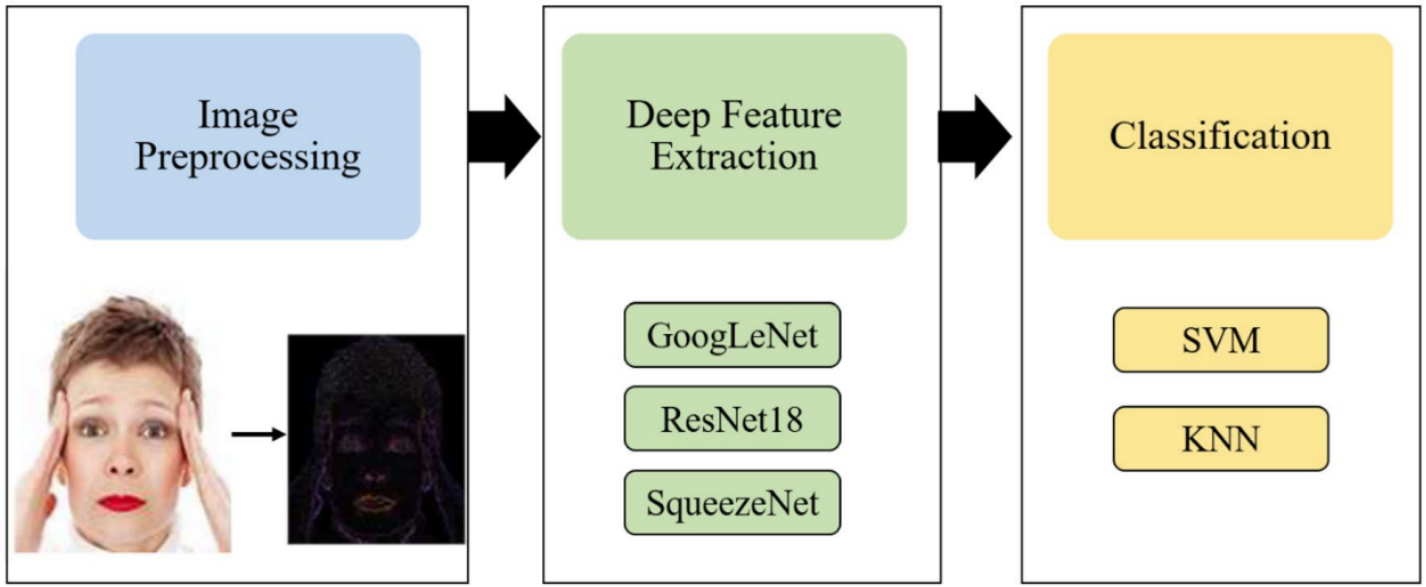


Image
Video
Audio
landmarks
Boundaries
ActionUnits
Texture
Audio Features
HANDCRAFTED FEATURES
DEEPFEATURES
Real
Fake
Real
INPUT
PREPROCESSING
FEATURE EXTRACTION
CLASSIFICATION
OUTPUT

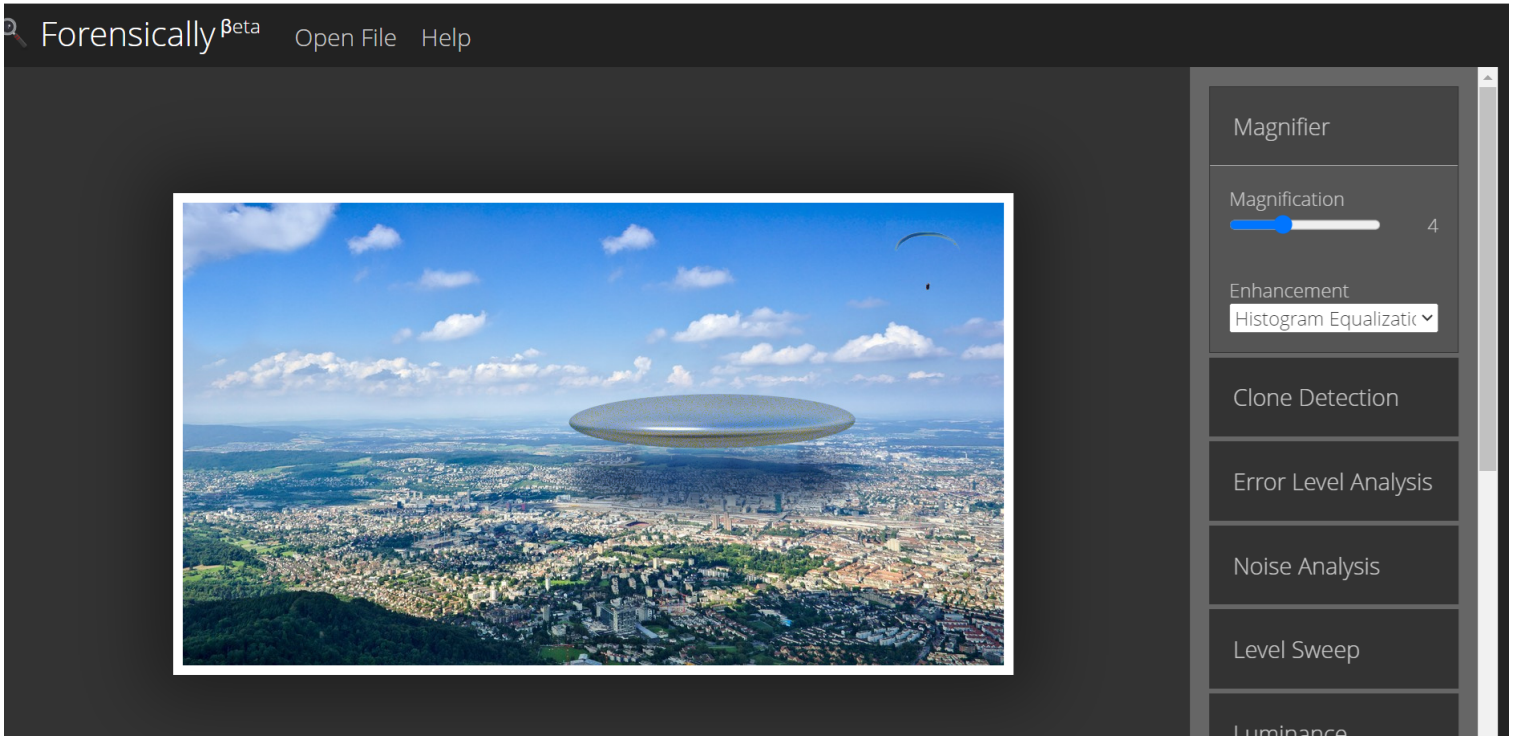
Error level analysis [26]



Error level analysis + Deep Learning [31]



Forensically [24]



Aspetti legali

IA act, 2024

70a) A variety of AI systems can generate large quantities of synthetic content that becomes increasingly hard for humans to distinguish from human-generated and authentic content. The wide availability and increasing capabilities of those systems have a significant impact on the integrity and trust in the information ecosystem, raising new risks of misinformation and manipulation at scale, fraud, impersonation and consumer deception. **In the light of those impacts, the fast technological pace and the need for new methods and techniques to trace origin of information, it is appropriate to require providers of those systems to embed technical solutions that enable marking in a machine readable format and detection that the output has been generated or manipulated by an AI system and not a human.** Such techniques and methods should be sufficiently reliable, interoperable, effective and robust as far as this is technically feasible, taking into account available techniques or a combination of such techniques, such as watermarks, metadata identifications, cryptographic methods for proving provenance and authenticity of content, logging methods, fingerprints or other techniques, as may be appropriate

Conseguenze di un uso improprio dei deepfake [25]

Uso improprio dei deepfake

- Diffamazione, attraverso la creazione di contenuti che denigrano o danneggiano la reputazione di un individuo
- Furto di identità, che rileva nel caso della creazione di video o audio in cui un soggetto viene rappresentato come un'altra persona
- Violazione della privacy, attraverso la condivisione non consensuale di informazioni relative a una persona

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