



# LARGE-SCALE VIDEO ANALYSIS

StormCV & Media Distillery | John Schavemaker, Corne Versloot, Joost de Wit, Geert Vos

**TNO** innovation  
for life

# TNO

**INDUSTRY**

**HEALTHY LIVING**

**DEFENCE, SAFETY & SECURITY**

**URBANISATION**

**ENERGY**



FLEXIBLE & FREE-FORM PRODUCTS  
SPACE & SCIENTIFIC INSTRUMENTATION  
SUSTAINABLE CHEMICAL INDUSTRY  
SEMICONDUCTOR EQUIPMENT  
NETWORKED INFORMATION



FOOD & NUTRITION  
PREDICTIVE HEALTH TECHNOLOGIES  
PREVENTION, WORK & HEALTH



MISSIONS & OPERATIONS  
FORCE PROTECTION  
INFORMATION SUPERIORITY  
HUMAN EFFECTIVENESS  
CYBER SECURITY & RESILIENCE  
NATIONAL SECURITY & CRISIS MANAGEMENT



MOBILITY & LOGISTICS  
ENVIRONMENT & SUSTAINABILITY  
BUILDINGS & INFRASTRUCTURES  
SMART CITIES



SUSTAINABLE ENERGY  
GEO ENERGY  
GEOLOGICAL SURVEY OF THE NETHERLANDS  
MARITIME & OFFSHORE

# TNO: FROM IDEA TO INNOVATION

**DEVELOPING  
FUNDAMENTAL  
KNOWLEDGE**



With universities

**KNOWLEDGE  
DEVELOPMENT**



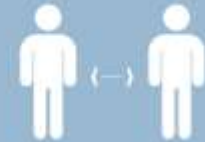
With partners in  
the golden triangle

**KNOWLEDGE  
APPLICATION**



Contract research  
for and with customers

**KNOWLEDGE  
EXPLOITATION**



Embedding in the market  
(with TNO companies)

# › MEDIA & NETWORK SERVICES

◀ Select content



*Tiled Streaming @ The Netherlands vs. USA (3-4)*



# MEDIA DISTRIBUTION & MEDIA MINING

New TV concepts:

- › media distribution:-
  - › Tiled streaming
  - › Media synchronization (inter device)
  
- › media mining:-
  - › personal/group recommendations
  - › content analytics and annotation:
    - › logo recognition, subtitle reading
    - › face recognition, ...





our challenge: more and more video content

## TWO STORIES

### TNO github

- › share model
- › open-source tools
- › open-source result
- › open-source as a business strategy?

### TNO spin-off

- › experiment with features
- › customer validation
- › sharing annotation platform
- › open-source tools

# OPEN SOURCE/SHARING



STORM





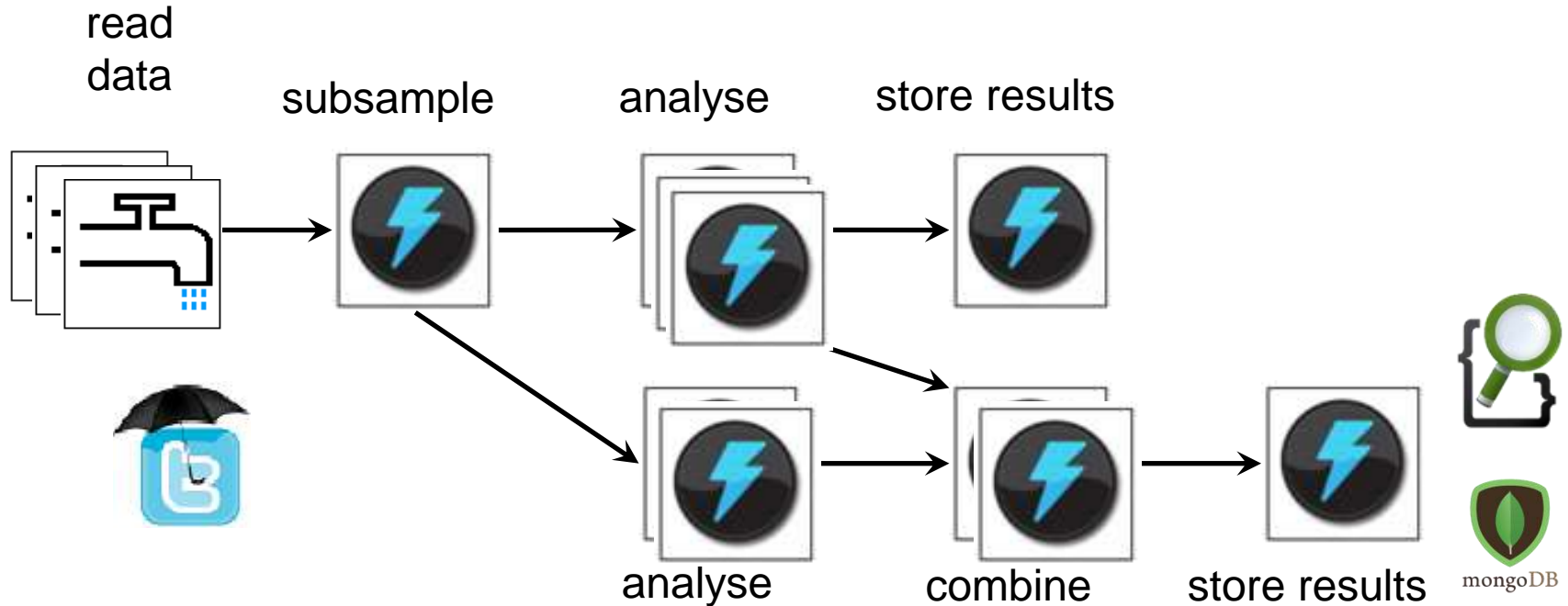
# GITHUB: STORMCV

parallel, distributed processing of sensor/video data with automatic scaling

# STREAMING PLATFORMS

PLATFORMS:	HStreaming	Yahoo S4	Apache Storm
real-time analysis	Yes	Yes	Yes
never ending streams	Yes	Yes	Yes
text, A/V, sensor data	Yes	unknown	Yes
continue after failure	Yes	Yes	Yes
multiple interfaces	Yes	Yes	Yes
stateful	Yes	Yes	Yes
open source	No	Yes	Yes

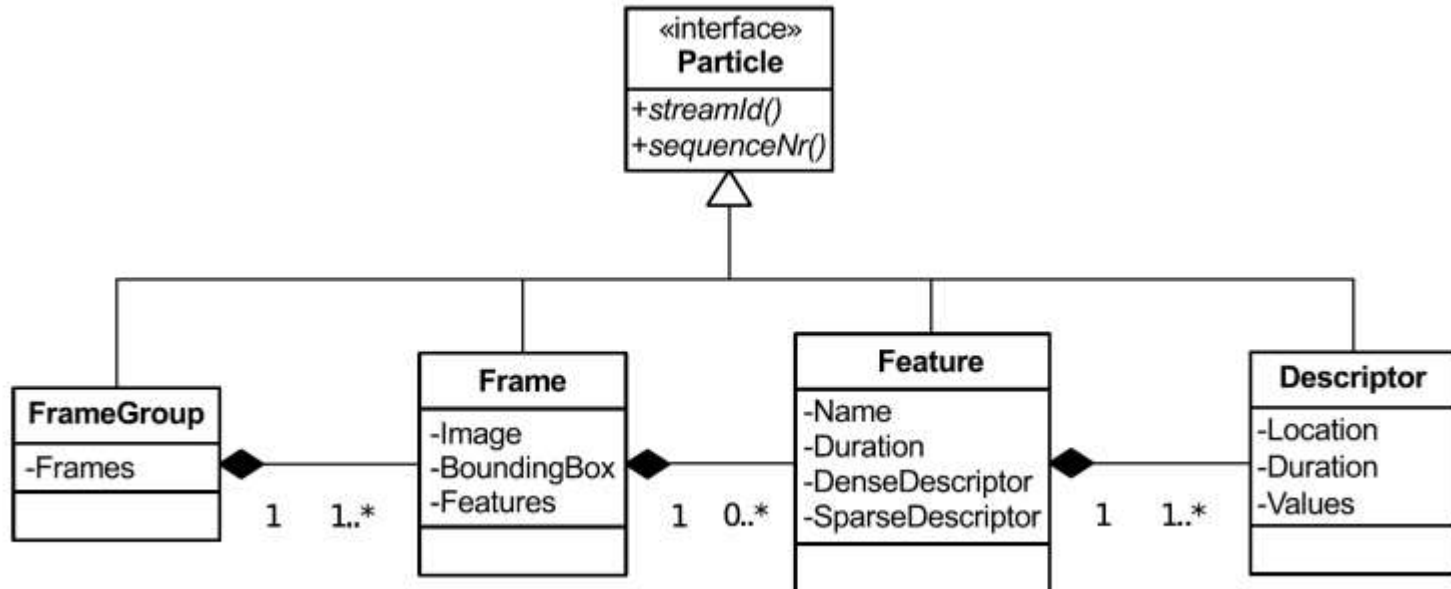
# APACHE STORM TOPOLOGY CONCEPTS



# ATOMIC ELEMENTS AND DIMENSIONS

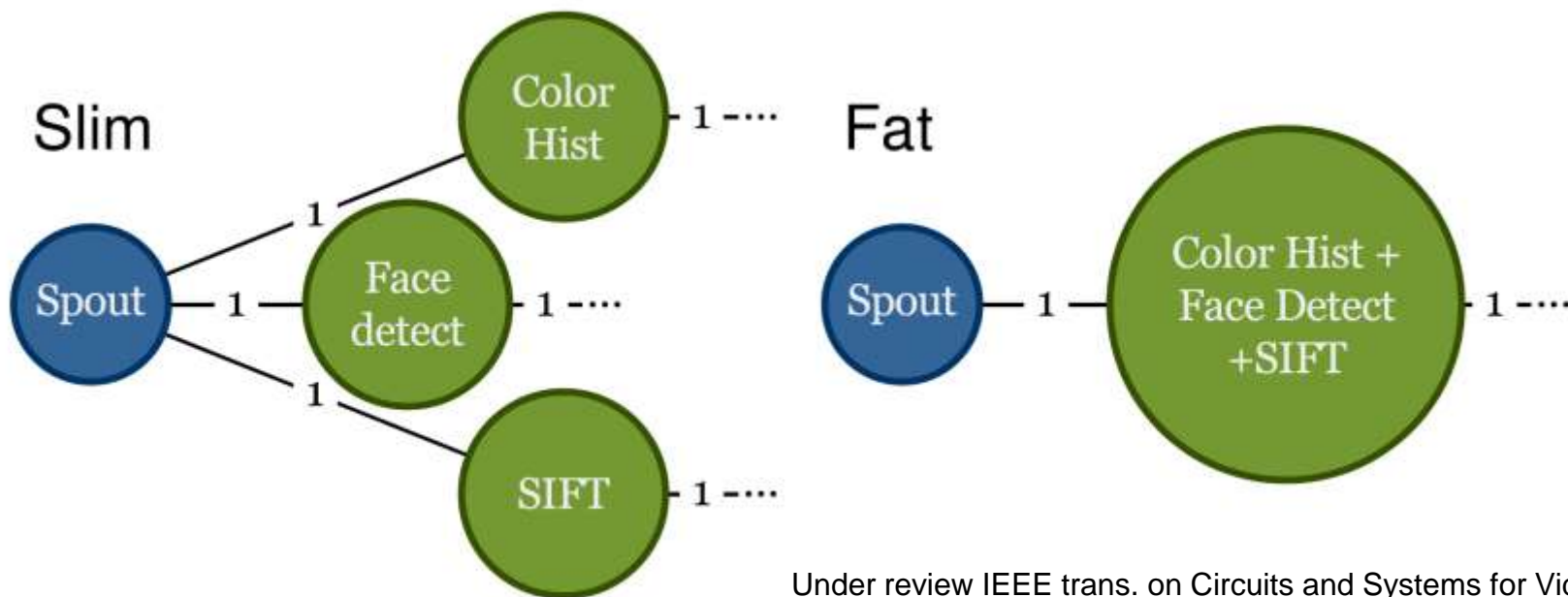
granularity/atomic element	processing dimensions
video stream	memory [Mb]
video segment	(network) bandwidth [Mb/s]
video frame	memory state (history)
video frame pair	persistent state
frame tiles	(video frame/time) ordering

# TNO CONTRIBUTION: VIDEO FRAME PARTICLES



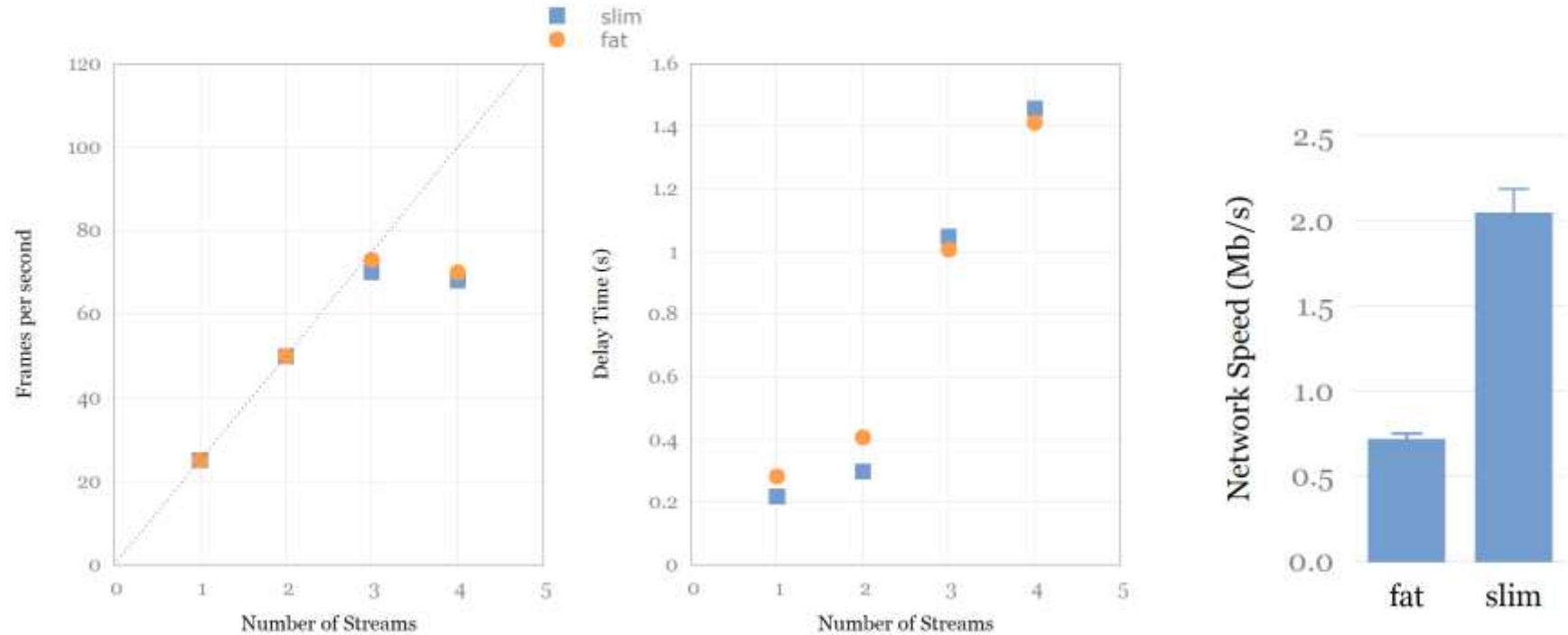


# TOPOLOGY EXPERIMENTS: SLIM VS. FAT



Under review IEEE trans. on Circuits and Systems for Video Tech.

# FAT IS GOOD BUT LESS FLEXIBLE

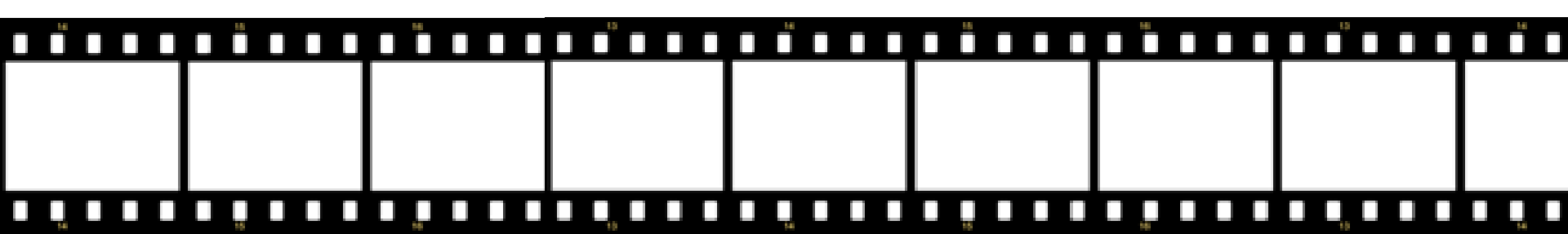




# SPIN OFF: MEDIA DISTILLERY



**TNO**



**EPG**

**NOS Journaal**

**Speech**

**Het Nederlands elftal is voor een**

**Het Nederlands elftal is voor een**

**Logo**

**ING**

**Topic**

**Voetbal**

## INNOVATION STEPS

- › first idea at TNO
- › prototype development with national partners
- › 1st customer pilot with commercial party
- › “How do we bring this to the market?”



## ACCELERATE

- › 25 radio & TV channels
- › national and regional
- › news and news programs
- › 150 programs a day
- › French & German coming



# TV IS DEAD

Right?



#	title	channel	viewers
1	JOURNAAL 20 UUR	NPO1	2.053.000
2	GOEDE TIJDEN SLECHTE TIJDEN	RTL4	1.637.000
3	WERELD DRAAIT DOOR	NPO1	1.347.000
4	RIJDENDE RECHTER	NPO1	1.322.000
5	OPSPORING VERZOCHT	NPO1	1.179.000
6	HALF ACHT NIEUWS	RTL4	1.167.000
7	JO FROST NANNY ON TOUR	RTL4	1.090.000
8	HERMAN EN MARTIJN OP DE ...	RTL4	1.090.000
9	EENVANDAAG	NPO1	1.023.000
10	JOURNAAL 18 UUR	NPO1	1.004.000

NOS

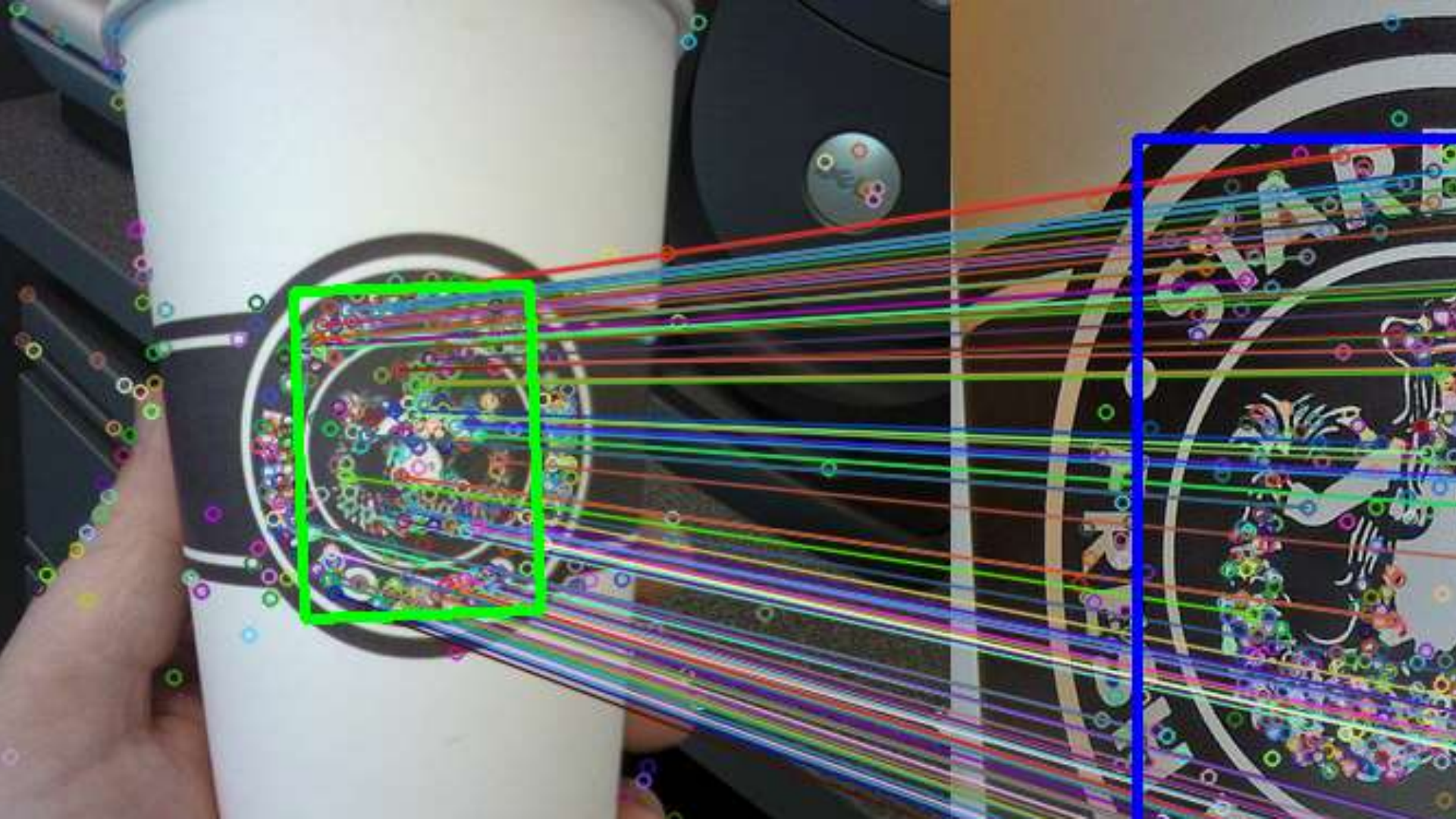


Obama



Sasha





THANK YOU FOR YOUR  
ATTENTION

**TNO** innovation  
for life

SAMSUNG

**JOHN.SCHAVEMAKER@TNO.NL**

**WWW.TNO.NL**

**GITHUB.COM/SENSORSTORM/STORMCV**

**WWW.MEDIADISTILLERY.TV/**