

# PhotoDNA:

Fighting Online Child Sexual Abuse Through  
Public/Private Partnerships



# Microsoft Digital Crimes Unit



**Transforming** the fight against digital crime  
through **partnerships** and legal and  
technical

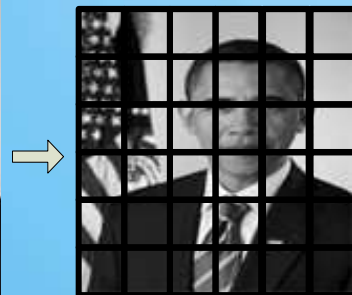
**breakthroughs** that **destroy** the way  
cybercriminals operate

# PhotoDNA: How It Works

- Originally developed by Microsoft and Dartmouth in partnership with NCMEC to enable online service providers to better detect child pornography images amongst the billions of images shared online
- Creates a unique signature of a given image (see below), which can be compared against other signatures to find a match
- With PhotoDNA, NCMEC has created a set of signatures of the worst known images of child pornography for online services to be on the lookout for



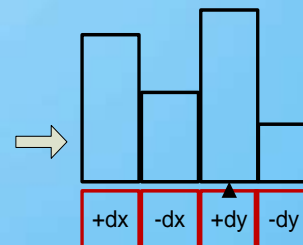
Input



Convert to GrayScale,  
Downscale and split into  
Numbins<sup>2</sup> regions of  
size QuadSize<sup>2</sup>



Calculate Intensity  
derivatives for each pixel in  
the region



Create a histogram adding  
the absolute value of each  
derivative on it's  
corresponding bucket for all  
pixels in a patch

# PhotoDNA vs Other Hashing

- Identify copies of known **images** (not copies of files, as other hashing tech does, but images themselves), even when images are slightly altered by common Internet variations, such as resizing, color shifts and file type changes
- Lightweight enough for use at large scale
- Reliable enough to avoid false positives



Windmill.jpg

**MD-5 Hash** = 4eecb453b9b000e8a4b4db09283e65c

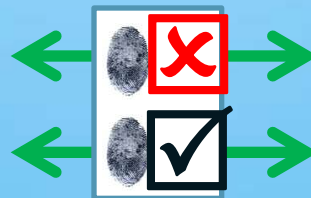
**PhotoDNA** = 2,6,2,11,4,10,5,12,12,13,58,9,14,6,26,10,6,0,4,1,2,1,2,0,0,8,8,5,138,15,43,3,178,12,188,66,255,101,37,25,12,4,217,16,18,0,218,12,15,21,255,1,26,8,255,5,132,29,255,39,70,156,255,12,31,5,255,4,38,2,255,5,0,44,45,48,6,33,53,57,111,22,48,37,57,119,58,31,18,4,56,34,23,1,48,



Windmill.gif

**MD5 Hash** = 31dda33f9f1034b25e217c4740825633

**PhotoDNA** = 2,6,2,11,4,10,5,12,12,13,58,9,14,6,26,10,6,0,4,1,2,1,2,0,0,8,8,5,138,15,43,3,178,12,188,66,255,101,37,25,12,4,217,16,18,0,218,12,15,21,255,1,26,8,255,5,132,29,255,39,70,156,255,12,31,5,255,4,38,2,255,5,0,44,45,48,6,33,53,57,111,22,48,37,57,119,58,31,18,4,56,34,23,1,48,30,12,2,





# Creating a PhotoDNA Signature

1



2



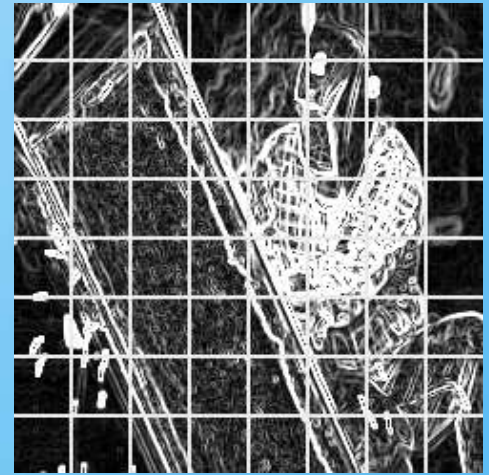
3



4



5



6

\* Slide provided courtesy of Dartmouth College



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# NCMEC PhotoDNA Model

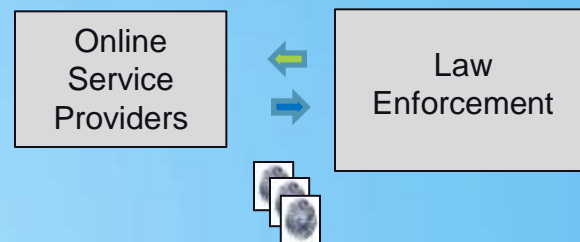


# A Variety of Possible PhotoDNA Models

## NCMEC model:



## Another possible model:



## Third party product model:



## Other Models



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