

# Technologies Beyond 4 K.....

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**Abstract** - In this paper, we propose a novel solution for 4K-HDTV system that combines a super-resolution system and a noise removable system. The super-resolution system consists of total variation (TV) regularization decomposition, a shock filter, and a pulse enhancement filter, and the compression noise removable system consists of the TV regularization decomposition and a deblocking edge filter (DEF). We obtain good results in terms of picture quality. And we implement our system on GPGPU, and we achieve both noise remove and super-resolution from Full-HD to 4K-HD resolution conversion in real time. We consider this system to be a practical solution, especially for the super-resolution of HDTV broadcasting signal for devices such as 4K-HDTV receivers and PCs with 4K display panels.

**Keyword**—4k, Broadcasting, Live TV

## I. AN INTRODUCTION OF 4K

One of the biggest technology trends hitting every level of consumer electronics in the last year has been the demand for an ever sharper, crisper, higher resolution picture. This trend of increased resolution has been further fuelled by the real world adoption of the 4K TV in 2015. While 4K is not in itself a new idea (4k televisions have been unveiled at the Consumer Electronics Show in the past), it was in 2015 that 4K television became a realistic proposition for most consumers. This is a result of a huge price reduction for 4k televisions – now moderately priced at below £1000 in the premium market, and below £500 for a lower end set. An added factor is big brand streaming services like Amazon, Netflix & YouTube who have now also introduced 4K content. The television while being the most common way watch 4K content is not the only appliance in our homes to see a 4K bump. Every new generation of smartphone, smartwatch, laptop, and tablet tends to include resolution as staple improvement to the spec sheet with each generation. 4K has now become the next new 'must have' feature for your smart phone.

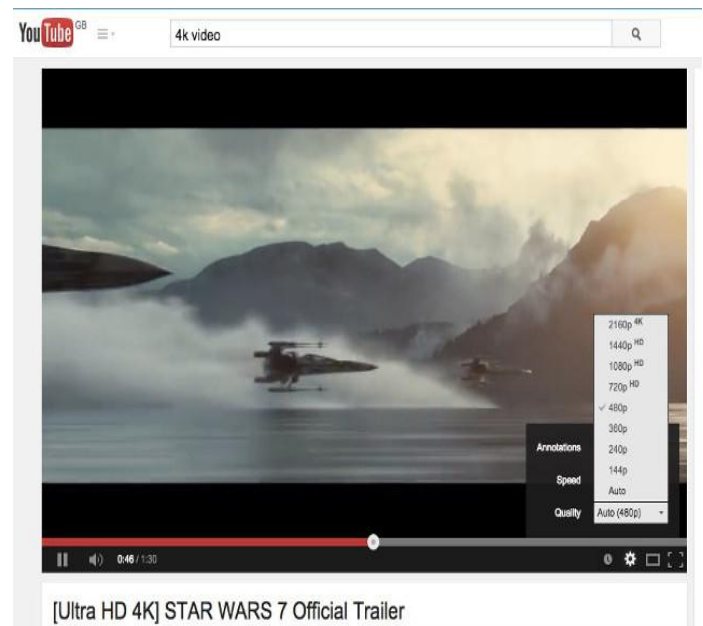
## II. WHAT EXACTLY IS 4K?

4K, also known as Ultra HD, refers to a resolution of 3840x2160 pixels. That's four times the 1920x1080 pixels found in your full HD TV.

### History

The first commercially available 4K camera for cinematographic purposes was the dalsa origin, released in 2003. You tube began supporting 4K for video uploads in 2010 as a result of leading manufacturers producing 4K cameras. Users could view 4K video by selecting "Original" from the quality settings until December 2013, when the

2160p option appeared in the quality menu. In November 2013, YouTube started to use the VP9 video compression standard, saying that it was more suitable for 4K than High efficiency video coding (HEVC); VP9 is being developed by Google, which owns YouTube.



The projection of movies at 4K resolution at cinemas began in 2011. Sony was offering 4K projectors as early as 2004. The first 4K home theatre projector was released by Sony in 2012. Sony is one of the leading studios promoting UHDTV content, as of 2013 offering a little over 70 movie and television titles via digital download to a specialized player that stores and decodes the video. The large files (~40GB), distributed through consumer broadband connections, raise concerns about data caps. In 2014, Netflix began streaming House of Cards, Breaking Bad, and "some nature documentaries" at 4K to compatible televisions with an HEVC decoder. Most 4K televisions sold in 2013 did not natively support HEVC, with most major manufacturers announcing support in 2014. Amazon studios began shooting their full-length original series and new pilots with 4K resolution in 2014.

Home video projection



Though experiencing rapid price drops beginning in 2013 for viewing devices, the home cinema digital video projector market saw little expansion, with only a few manufacturers (only Sony As of 2015) offering limited 4K-capable lineups, with native 4K projectors commanding five-figure price tags well into 2015 before finally breaking the US\$10,000 barrier. Critics state that at normal direct-view panel size and viewing distances, the extra pixels of 4K are redundant at the ability of normal human vision. On the contrary, home cinema employs much larger screen sizes without necessarily increasing viewing distance to scale. JVC has used a technique known as "e-shift" to extrapolate extra pixels from 1080p sources to display 4K on screen through upscaling or from native 4K sources at a much lower price than native 4K projectors. This technology of non-native 4K entered its fourth generation for 2016.

Broadcasting

In November 2014, United States satellite provider Direct TV became the first pay TV provider to offer access to 4K content, although limited to selected video-on-demand films. In August 2015, British sports network BT Sport launched a 4K feed, with its first broadcast being the 2015 FA community shield football match. Two production units were used, producing the traditional broadcast in high-definition, and a separate 4K broadcast. As the network did not want to mix 4K footage with upconverted HD footage, this telecast did not feature traditional studio segments at pre-game or half-time, but those hosted from the stadium by the match commentators using a 4K camera. BT envisioned that if viewers wanted to watch studio analysis, they would switch to the HD broadcast and then back for the game. Footage was compressed using H.264 encoders and transmitted to BT Tower, where it was then transmitted back to BT Sport studios and decompressed for distribution, via 4K-compatible BT TV set-top boxes on an eligible BT infinity internet plan with at least a 25 Mbit/s connection.

Live Tv

As for watching live TV in ultraHD, your options are rather limited aren't any tv stations that regularly broadcast in 4k in the US and the UK though occasional events available, and a number of providers are talking about trails that you might be able to take part in.

Where Do You Get 4k

Let us know what you're able to find and the strategies that you find useful for finding 4k movies, TV shows, and videos.

A new look for older for older games

Most reviews about gaming at 4k focus on new and demanding games like need for speed and GTA VICE CITY etc. That's understandable. Better textures and graphics will benefit from a higher resolution, right everyone knows that. You might be surprised, however, by what 4k can do for older games. It's important to note that by "older" I am taking about titles like league of legends and Dablo 3. These games are arepopular, but they aren't demanding, so it is not hard for a modest video card to produce smooth game play at 3840\*2160. These games also have a well defined style that looks great at resolution. Gaming at 4k reduces the prevalence of anti-aliasing artefacts and makes fine detail more visible, which means at assets have a chance to really shine. League of legends, characters for example; startto look less like 3D models and more like finely detailed sprites drawn from an infinite number of perspectives. Upgrading from a 24"1080p display to a 28" 4K monitor can provide an obvious visual upgrade without any other hardware involved. There is good news for a player who plays games on laptop, PC because of upgrading of technology.

Resolution

Format	Resolution	Display Aspect Ratio	Pixels
Ultra definition television	High 3840 × 2160	1.78:1 (16:9)	8,294,400
Ultra wide Television	wide 5120 × 2160	2.37:1 (21:9)	11,059,200
DCI 4K (Native Resolution)	4096 × 2160	1.90:1 (256:135)	8,847,360
DCI 4K (Cinema scope cropped)	4096 × 1716	2.39:1 (1024:429)	7,028,736
DCI 4K (flat cropped)	3996 × 2160	1.85:1 (999:540)	8,631,360

Ultra HD

UHD is a resolution of 3840 pixels × 2160 lines (8.3 megapixels, aspect ratio 16:9) and is one of the two resolutions of ultra high definition television targeted towards consumer television, the other being 8K UHD which is 7680 pixels × 4320 lines (33.2 megapixels). UHD has twice the horizontal and vertical resolution of the 1080 HDTV with four times as many pixels overall. Besides resolution, the UHD standard and related technologies (e.g. HDMI 2.0) include other higher specifications such as a wider REC.2020 colour palette.

RECORDING



The main advantage of recording video at the 4K standard is that fine spatial detail is resolved well. If the final video quality is reduced to 2K from a 4K recording more detail is apparent than would have been achieved from a 2K recording. Increased fineness and CONTRAST is then possible with output to DVD and BLU RAY. Some cinematographers choose to record at 4K when using the super 35 film format to offset any resolution loss which may occur during video processing.

### III. DIFFERENCE BETWEEN 4K &UHD

Now, we've been using the terms 4K and UHD interchangeably so far and while they basically are interchangeable at the commercial level, they do actually also mean slightly different things. While most UHD that you'll find on TV screens is actually 3,840 pixels as mentioned above, it still gets called 4K because it does after all offer 4 times the resolution profile of regular HD. However, in a more specialized context, proper 4K is what is most often found as a digital camera resolution standard that involves an actual 4,096 x 2160 pixel resolution at an aspect ratio of 1.9:1 (horizontal: vertical) as opposed to common TV based 3,840p width and aspect ratios of 16:9 or 1.78:1.

Basically, regardless of the fact that 4K TV is officially defined as UHD, you're buying into the same thing whether you see either 4K or Ultra HD used to describe a TV, monitor or film/Photo camera. is officially defined as UHD, you're buying into the same thing whether you see either 4K or Ultra HD used to describe a TV, monitor or film/Photo camera.



Most 4K projectors offer at least 4,096 x 2,160 pixels of resolution and because they typically offer projection area sizes that totally dwarf all but the largest 4K TVs, this is where you really notice the difference between UHD and regular HD content. With a projector showing native 4K content or even up scaled 1080p HD content, you finally get to experience picture clarity in your own home that imitates on a smaller scale what you'd find with a large UHD public theatre screen.

#### Wide Colour Gamut

There is another crucial aspect of modern 4K TV content is colour gamut technology, or the ability to deliver the largest possible range of rich colours for the greatest possible realism and vibrancy. Currently, many 4K TVs are thus starting to offer colour ranges that conform two two particularly broad gamut's called DCI P3 (which is frequently used in commercial cinematic display) and REC.2020, which is the current "Wide Colour Gamut" gold standard for 4K ultra HD.

However, not all 4K content fits these higher quality standards and much of the video and 4K TV display technology still on sale is REC.709, which was developed for older HDTV display technology.

### IV. ADVANTAGE AND DISADVANTAGES OF 4K TECHNOLOGY

#### Advantages

1. The greater the resolution is, the better the quality.
2. The colour depth may reach 12 colour bits compared to the 10 usual ones of the Full HD.
3. The H.265 Codec or HEVC used to process 4k duplicates the compression relationship of the H.264 but maintaining the same quality.
4. Camera, television and mobile phone creators are betting more and more for the 4K.

#### Disadvantages

1. The content recorded in 4K is still limited.
2. To transfer videos in 4K it is necessary to have a minimum bandwidth of 25Mbps.
3. The exported archives are very heavy and take up a lot of space.
4. The prices of 4K televisions are not accessible for all pockets.

### V. APPLICATIONS OF 4K UHD TECHNOLOGY IN CONTROL ROOM DESIGN

#### Notable exceptions

Some video wall applications are apparent exceptions to the guidelines above because they often require close-up inspection of ultra high resolution images. These include

Medical imaging.

Simulation modelling such as oil & gas exploration.

Manufacturing inspection systems.

Aerial reconnaissance.

Megapixel surveillance.

In these cases, users needing more visibility are likely to walk right up to a video wall, shortening their viewing distance of imagery so much that it makes sense to choose the highest resolution displays. 4K UHD processing equipment and video wall monitors are a logical choice in applications like these where minute details matter and video wall imagery may be subjected to close-up inspection.

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