

**Pinnacle Imaging Systems
Video IP Cores and Algorithms
Background and Overview**

In 2011, Pinnacle under Unified Color set out to utilize development of a unique set of IP for still imaging HDR and transfer that core group of IP’s and knowledge into the embedded video space, creating unique IP and leading video quality solutions for high contrast video situations in numerous video application areas.

Today, Pinnacle has a technical team in Moscow, led by Dr. Igor Vanyushin, (Moscow Institute of Physics), design centers in San Diego, CA and Santa Clara and offices in Belmont, CA. Pinnacle has PHD level experts in algorithm development, sensor design and characterization, DSP/ISP/VSP and FPGA logic. Pinnacle is funded by investors in Hong Kong and Taiwan and has sister companies and distributors in Taiwan and China.

Our Ultra HDR™ IP

Currently, there are 3 methods used for providing high dynamic range, which compete within the markets Pinnacle is engaged in; conversion gain / multi-readout long/short exposures using sensor readout timing. Top sensor providers typically use a multi-readout method of 2 exposures, Sony now incorporates DOL HDR, a 3 exposure readout.

Pinnacle Imaging Systems is involved with partner sensor companies that provide both conversion gain and intra-scene WDR, which can be combined with Pinnacle’s UHDR™ multi-frame merge IP’s (up to 4 frames) 120+ dB and proprietary local tone mapping, de-ghosting and anti-glare to provide the most diverse options and highest dynamic range available.

Further enhancing the value of Pinnacle’s offering are best in class alignment, deghosting, auto-exposure, auto halo adjustment and tone-mapping algorithms, not offered by HDR sensor providers.

Ultra HDR™ IP Core Applications

Surveillance

- PTZ Cameras
- CCTV Cameras
- Consumer IoT
- Data Recognition Cameras



Traffic and Transportation

- Intelligent Traffic Systems
- Surveillance in Transportation Centers
- High Contrast Scene Video and Still Capture
- Speed and Red Light Detection and Enforcement
- License Plate Recognition
- Driver Recognition
- Oncoming Headlight Suppression



Surveillance Camera

Automotive Camera Systems

- High Contrast Scene Video and Still Capture
- Oncoming Headlight Suppression
- Adaptive Fog Elimination
- Veiling Glare / Lens Flare Elimination
- Enhanced Dusk and Dawn Video and Still Capture



Traffic and Transportation



Automotive Camera Systems

Wearable Camera Systems

- Action Cameras
- Police Body Cameras
- Consumer UAV Cameras
- Drone Cameras
- Connected Cameras



Wearable Camera Systems

Vision Systems

- Military
- Industrial
- Astronomy
- Life Sciences
- Video Forensics



Vision Systems

Our Mission

Pinnacle’s mission is to provide the highest level of dynamic range and video quality for high contrast scenes. Our approach is to combine sensor-based WDR with our patent pending Ultra HDR™ IP blocks and cores. This improves the dynamic range well above the native output of a sensor. We add to this various frame merging techniques and algorithms, combined with our proprietary Internal Color Space and the highest quality Locally Adaptive Tone Mapping available to provide enhanced value to camera systems across numerous segments.

We recognize that data is dark unless it can be used, which is an enormous problem especially where data detection and recognition algorithms are utilized in post capture within these segments.

Agnostic Approach with Sensors and Logic

Pinnacle’s agnostic approach to providing Ultra HDR™ Video allows it to utilize any applicable combination of low, mid and high-end image sensors and logic, various gain, exposure and scene improvements, at the sensor level and can be used in combined with proprietary frame merge IP Cores. Pinnacle’s merge IP core blocks are capable of 2, 3 and 4 frame merges and are meant to be utilized with Pinnacle’s proprietary LATM IP block and supportive IP cores or as stand-alone IP blocks.

For example, some sensors produce up to 115 dB, at 1080p/60fps, which may not need further dynamic range improvement for the application, but need Pinnacle’s Locally Adaptive Tone Mapping IP cores for adaptive scene improvement. Some sensors produce about 65 dB in their native mode and can utilize an added boost in range to 120dB utilizing Pinnacle’s 4 frame merge, or Pinnacle’s 2 frame merge with no visible artifacts for improved motion capture.

For more information, please contact Ron Tussy at (650) 631-5737 or email at ron@pinnacleimaging.com or visit www.ultrahdrvideo.com

Pinnacle’s IP Blocks and Cores Segmentation

Pinnacle IP Blocks / Cores	Merge Block IP Cores	Supportive IP or Part of ICS	Locally Adaptive Tone Map Block IP	Stand Alone IP Cores	In Dev. or Requires Custom NRE
4-Frame Merge	■			■	
3-Frame Merge	■			■	■
2-Frame Merge	■			■	■
Ultra HDR™ ALTM			■		
Auto Halo Adjustment	■		■		
Auto Exposure		■		■	
Auto White Balance		■		■	
Alignment		■		■	
De-Ghosting		■			
Moving Objects Correction		■		■	
Veiling Glare		■		■	
Suppression of Transition Noise		■			
Optimized LDR before Merge HDR	■	■		■	
Lens Distortion Correction				■	■
Optional Manual /Auto WB		■		■	■
Optional Manual / ALTM		■			■
Conversion from Sensor Domain-ICS		■		■	■
Conversion from ICS to Standard		■		■	■
Variable ROI Veiling Glare		■		■	■
SNR Priority Merging	■	■			■
Auto ALTM in ROI		■		■	■
De-noising in Post		■		■	■
De-mosaicing					■