

UNIVERSITI PUTRA MALAYSIA

RAIN STREAK REMOVAL USING EMBOSS AND SPATIAL-TEMPORAL DEPTH FILTERING TECHNIQUE IN VIDEO KEYFRAMES

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RAIN STREAK REMOVAL USING EMBOSS AND SPATIAL-TEMPORAL DEPTH FILTERING TECHNIQUE IN VIDEO KEYFRAMES



By

SAWSAN KAMEL SHARIAH

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirement for the Degree of Doctor of Philosophy

February 2012

This thesis is

Dedicated to my late father Dr Kamel Shariah, who taught me that the best kind of knowledge to gain is which learned for its own sake believing in the richness of learning. He always taught me that even the largest task can be accomplished if it is done one step at a time; I also dedicate this thesis to my mom who introduced me to the joy of reading from birth enabling such a study to take place today. Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

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Faculty : Engineering

Dynamic weather elements such as rain cause complex visual appearance, because rain consists of spatially distributed drops falling at high velocities. The continuous movement in spatio-temporal depth causes the distraction in the motion in a video sequence. Each drop when falling in high speed will create a streak motion blurred illusion based on the background intensity that reflects the environment creating higher intensity pattern in an image.

In this thesis rain streak have been captured and isolated from the background scene by using an embossed filter algorithm designed to highlight the transparent rain streaks that cause the blur and distortion of the video, while the removing algorithm is based on a simple algorithm that correlates spatio-temporal and depth of an image into one technique. The removing method was based on the filtration process applied on the divided image blocks in the spatio-temporal depth technique controlled by an automatic steerable on noise availability in the image. The filter algorithm is based on an enhanced harmonic mean filter algorithm. Different techniques were applied conducted with different kernel structure. The image was clustered into layers, separating the RGB layers from the rain in one of the filters. In another filter a nested kernel was designed with the applicability of the main filter process. In another approach the image components are divided into two space criteria, conducting it in two different spaces and rejoined together. The kernel coefficients were automatically been set based on the noise availability in the image. The results obtained were satisfying, where the algorithm were able to detect and remove the rain streaks without losing the aliveness of the scene. The techniques presented here can be used in a wide range of applications including video surveillance, vision based navigation, video editing and video indexing. Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

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Unsur-unsur cuaca dinamik seperti hujan menyebabkan paparan visual yang kompleks, kerana hujan terdiri daripada titisan taburan ruang yang jatuh pada halaju tinggi, menyebabkan garguan. Pergerakan berterusan terhadap keddaman ruang - masa urutan video. Setiap titisan apabila jatuh dalam kelajuan tinggi akan mewujudkan ilusi coretan gerakan kabur berdasarkan keamatan latar belakang yang mencerminkan persekitaran yang mewujudkan corak intensiti yang lebih tinggi dalam imej.

Dalam tesis ini coretan hujan telah ditumpal dan diasingkan dari latar belakang dengan menggunakan algoritma penapis timbul yang direkabentrk untuk menyerlahkan jalur-jalur lutsinar hujan telus yang menyebabkan kabur dan herotan video, manakala algoritma mengeluarkan berdasarkan algoritma mudah yang ada hubung kait spatio-duniawi dan mendalam imej ke dalam satu teknik. Kaedah mengeluarkan adalah berdasarkan proses penapisan yang dikenakan ke atas blok imej yang dibahagikan dalam teknik spatio-duniawi kedalaman yang dikawal oleh kemudi automatik kepada ketersediaan noise dalam imej. Algoritma penapis adalah berdasarkan algoritma penapis min harmonik yang dipertingkatkan. Teknik-teknik yang berlainan digunakan dengan struktur kernel yang berlainan. Imej berkelompok ke dalam lapisan, yang memisahkan lapisan RGB dari hujan di salah satu penapis. Dalam penapis lain kernel tersarang telah direka dengan kebolehgunaan proses penapis utama. Dalam pendekatan lain komponen imej telah terbahagi kepada dua kriteria ruang, menjalankan dalam dua ruang yang berbeza dan mengumpul semula bersama-sama. Pekali kernel secara automatik ditetapkan berdasarkan ketersediaan bunyi pada imej. Keputusan yang diperolehi memuaskan, di mana algoritma dapat mengesan dan membuang jalur-jalur hujan tanpa kehilangan aliveness tempat kejadian. Teknik yang dipersembahkan di sini boleh digunakan dalam pelbagai termasuk pengawasan video, penglihatan aplikasi berasaskan navigation, penyuntingan video dan mengindeks video.

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APPROVAL SHEET

I certify that an Examination Committee has met on 2009 to conduct the final examination of Sawsan Kamel Shariah on her Doctor of Philosophy thesis entitled "Rain Streak Removal Using Emboss and Spatial-Temporal Depth Filtering Technique in Video Keyframes" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the degree of Doctor of Philosophy.

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DECLARATION

I hereby declare that the thesis is based on my original work except that for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions



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