Meteor candidate observations from automated weather camera sampling in VBA

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Automated sampling of webcam imaging is investigated as a means of meteor data collection. A sampling system was built with Visual Basic for Applications, the scripting language built into Microsoft's Office suite. Designed for use with an arbitrary set of target webcams, testing was performed with weather cameras on Australia's remote Norfolk Island, around the 2019 Perseid peak. Very probable meteor candidate imaging was secured, validating the viability of the data collection method. System source code has been made freely available.

1 Introduction

The goal of this work was to investigate the viability of automated webcam sampling for meteor data collection. Specifically, a system was envisaged that would perform unattended image downloads from an arbitrary number of user-specified public webcams. Additionally, an individually configurable sampling cadence would be used for each camera. If practical, it would allow observers to increase their observational coverage by collecting data from cameras distributed geographically, save money by using third party cameras, and save time by not requiring participation beyond program activation.

2 Methods

A webcam sampling system was built using Visual Basic for Applications (VBA). VBA was chosen as an implementation technology due to its ease of use (Hiestand, 2009), ubiquity and maturity (it's been part of Microsoft's Office suite since 1993, Getz and Gilbert 2006) and to leverage previous personal experience (e.g. Stenborg 2016).

The system manages webcams via a custom VBA class. Implementation included various functions within the broader set of Windows API functions, such as the base services, HTTP client library and URL moniker service. Downloaded files are given names containing a camera label and timestamp. For important sampling sessions, the system can be set to check for failed image downloads, symptomatic of internet connection loss, and sound an audible alert.

The Australian Bureau of Meteorology, with Airservices Australia, hosts weather cameras on Australia's remote Norfolk Island. Four publicly-accessible webcams[1], facing north, south, east and west, are situated at the international airport to provide visual confirmation of prevailing weather conditions. Each camera has a refresh rate of 120 s and provides sky coverage to an altitude of $\sim(34-35)^\circ$. Given the cameras' low light sensitivity (capturing stars to at least apparent magnitude 5.98) and Norfolk Island's good dark sky conditions (contribution of total night sky brightness due to light pollution $< 1\%$, Falchi et al. 2016), the cameras were deemed capable of capturing visual meteors and thus selected as a test set.

An observational test run was conducted over five nights centred on the Perseid peak of 2019 (solar longitude $\lambda = 140^\circ$, Kronk 2014), with the system downloading $\sim$5 MB of images per hour, per camera, to capture meteors.

3 Results

Figure 1 shows an example meteor candidate, captured at 2019-Aug-13 $15^{\mathrm{h}}58^{\mathrm{m}}04^{\mathrm{s}} \pm 2^{\mathrm{s}}$ UTC, near the Perseid peak. Plotting the meteor's apparent path on gnomonic star maps (Znojil 1988) revealed no correspondence with a shower, Perseid or otherwise, even allowing for larger effective radiant diameters to accommodate plotting errors (as per, e.g. Rendtel and Arlt 2017).

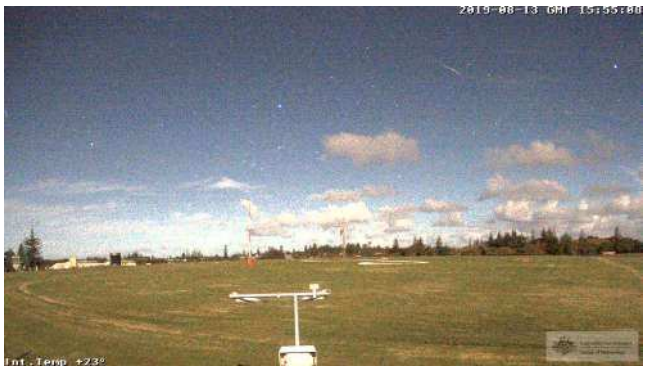

Figure 1 – Capture of a candidate sporadic meteor (top right image quadrant) near the 2019 Perseid peak. This image was taken via automatic sampling of online images from a weather camera on Norfolk Island.

[1] latitude $\approx -29.0388614^\circ$, longitude $\approx 167.9409638^\circ$

4 Discussion and Conclusion

The Perseids have a high ZHR (∼100, Kronk 2014), but bright time and poor southern hemisphere radiant visibility yielded no unambiguous Perseid detections. More limiting however, was camera imaging cadence. Weather cameras taking one image / 2 min are unlikely to capture meteors at a Perseid-like ZHR. Nonetheless, a strong sporadic candidate was captured, validating the data collection method at the proof-of-concept level.

System source code, embedded in an Excel workbook macro, has been uploaded to GitHub[2]. The community is encouraged to leverage its easy configurability and apply it to a webcam set beyond the weather cameras used here. Observational campaigns will naturally be constrained by the limitations of any webcam set selected, but can supplement traditional meteor data collection methods.

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[2] `https://github.com/tstenborg/Webcam-Sampler`