A Tool for Visualising the output of a DBN for fog forecasting (Abstract only)

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Abstract

Fog events occur at Melbourne Airport, Australia, approximately 12 times each year. Unforecast events are costly to the aviation industry, cause disruption and are a safety risk. Thus, there is a need to improve operational fog forecasting. However, fog events are difficult to forecast due to the complexity of the physical processes and the impact of local geography and weather elements.

Bayesian networks (BNs) are a probabilistic reasoning tool widely used for prediction, diagnosis and risk assessment in a range of application domains. Several BNs for probabilistic weather prediction have been previously reported, but to date none have included an explicit forecast decision component and none have been used for operational weather forecasting. A Bayesian Decision Network (Bayesian Objective Fog Forecast Information Network; BOFFIN) has been developed for fog forecasting at Melbourne Airport based on 34 years of data (1972-2005). Parameters were calibrated to ensure that the network had equivalent or better performance to prior operational forecast methods, which lead to its adoption as an operational decision support tool. The operational use of the network by forecasters over an 8 year period (2006-2013) has been evaluated [1], showing significantly improved forecasting accuracy by the forecasters using the network, as compared with previous years. BOFFIN-Melbourne has been accepted by forecasters due to its skill, visualisation and explanation facilities, and because it offers forecasters control over inputs where a predictor is considered unreliable.

However the static BN model now in operational use has no explicit representation of time and only forecasts whether or not a fog will occur for the remainder of the forecast period (until midday the following morning). It does not provide any way to predict the times of fog onset or clearance, which is of particular interest to the aviation companies, as this will allow them to adjust flight schedules and additional fuel loads. We have developed an initial prototype DBN which includes an explicit representation the fog status over the forecast period. More specifically, it includes 5 gweatherh variables, plus the length of night, over the 8 time-slices (3 hourly forecast times, starting at 12 midday). When building this prototype, we quickly found that it was difficult for both the BN knowledge engineer (author Boneh) and our fog domain experts, to inspect and understand the behaviour of the DBN, as its use was simulated over the 24 hr forecast cycle. This motivated the development of our fog DBN visualisation tool for understanding and exploring the output of the DBN. The was developed using D3 [2], a JavaScript library for manipulating documents based on data within a web browser, which uses a combination of HTML, SVG, and CSS. The original template of the tool was Matthew Weberfs “block” [3], which we’ve modified in a number of ways. The tool supports both the knowledge engineering process and the use of the resultant DBN by forecasters.

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References

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