

**Forensic intelligence:
Applications in illegal
drug trafficking**

by

Harmonie Michelot

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Certificate of original authorship

I, Harmonie Michelot, declare that this thesis is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the School of Mathematical and Physical Sciences at the University of Technology Sydney. This thesis is wholly my own work unless otherwise reference or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis. This document has not been submitted for qualifications at any other academic institution. This research is supported by the Australian Government Research Training Program.

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Abbreviations

- **ACBPS** : Australian Customs and Border Protection Services
- **ACT** : Australian Capital Territory
- **AFP** : Australian Federal Police
- **AIDDC** : Australian Illicit Drug Data Centre
- **AIDIP** : Australian Illicit Drug Intelligence Program
- **ATR-FTIR** : Attenuated Total Reflectance - Fourier Transform Infrared
- **APCI-ITMS-MS** : Ion trap tandem Mass Spectrometry with Atmospheric Pressure Chemical Ionization
- **AUC** : Area Under the Curve
- **CE-DAD** : Capillary Electrophoresis with Diode Array Detector
- **Corr** : Correlation
- **DEA** : Drug Enforcement Administration
- **DTB** : Direct Transfer experiment with Benchtop
- **DTF** : Direct Transfer experiment with Fingers
- **ELSD** : Evaporative Light Scattering Detector
- **ENIPID** : Enhanced National Intelligence Picture on Illicit Drugs
- **FASS** : Forensic and Analytical Science Service

- **FN** : False Negative
- **FP** : False Positive
- **GC-MS** : Gas Chromatography coupled to a Mass Spectrometer
- **HPLC** : High-Performance Liquid Chromatography
- **HS-GC-FID** : Head Space Gas Chromatography coupled to a Flame Ionisation Detector
- **ICPMS** : Inductively Coupled Plasma Mass Spectrometry
- **IMS** : Ionisation Mobility Spectrometry
- **IRMS** : Isotopic Ratio Mass Spectrometry
- **LC-MS** : Liquid Chromatography coupled to a Mass Spectrometer
- **LOD** : Limit of detection
- **LT** : Linear transformation
- **MA** : methylamphetamine
- **MDMA** : 3,4- Methylenedioxymethamphetamine
- **MEK** : Methyl ethyl ketone
- **MIBK** : Methylisobutylketone
- **N** : Normalisation
- **NMI** : National Measurement Institute
- **NPS** : New Psychoactive Substances

- **NSW** : New South Wales
- **PEDIT** : Physical Examination Data Input Template
- **PROMIS** : Police Real Time Online Management Information System
- **PTHIT** : Phenyltetrahydroimidazothiazole
- **ROC** : Receiving Operator Curve
- **SIM** : Single Ion Monitoring mode
- **Sqrt** : Square Root
- **STRL** : Special Testing and Research Laboratory
- **THC** : Tetrahydrocannabinol
- **TN** : True Negative
- **TP** : True Postive
- **UNODC** : United Nations Office on Drug and Crime
- **3-MAM** : 3-MonoAcetylMorphine
- **6-MAM** : 6-MonoacetylMorphine
- **10min A** : 10 minutes of Activity experiment
- **30min A** : 30 minutes of Activity experiment
- **1h A** : One hour of Activity experiment
- **12h P** : 12 hours Persistence experiment

- **24h P** : 24 hours Persistence experiment
- **2nd T** : Secondary transfer experiment

Abstract

This research aimed at getting a better understanding of illicit drug trafficking, especially from an Australian point of view, by looking at different approaches of getting valuable information in a timely fashion for forensic intelligence purpose. The study was conducted in collaboration with the Australian Federal Police (AFP) who provided appropriate data. In return, the study was expected to provide findings to grow their knowledge about such criminal phenomenon that is illegal drug trafficking.

Two distinct approaches were undertaken. The first one was an analysis of chemical results of cocaine and heroin border seizures performed by the AFP during 2008 and 2013. Trends regarding the purity as well as added compounds over time and per geographic location were discovered. Moreover, statistical methods were applied on the provided datasets to assess the feasibility to develop an automatic triage of those chemical results and highlighting links between seizures based on their chemical data. Promising results with few error rates were obtained, as cocaine seizures could be discriminated with 9.36 % of false positives and 2.45 % of false negatives, and heroin seizures could be discriminated with 4.82 % of false positives and 2.94 % of false negatives. Therefore, the automatic statistical model could be implemented for routine use at the AFP.

The second approach was a proof of concept study investigating the possibility to use currently deployed portable instruments for intelligence purpose instead of the traditional identification and case-specific aim that they are designed for. Three different technologies were tested, Attenuated Total Reflectance - Transform Infrared spectroscopy (ATR-FTIR), Ion Mobility Spectroscopy (IMS) and Ion trap tandem Mass Spectrometry with Atmospheric Pressure Chemical Ionization (APCI-ITMS-MS) for the detection of remnants of drugs present on the surface of passports, using various parameters including transfer, activity and persistence. An experimental design was developed and different scenarios were trialled. Promising results were obtained especially with APCI-ITMS-MS, as drugs' residues could be detected even after an activity of thirty minutes in quantities less than 0.05 µg. The findings demonstrate that a routine use at customs would be feasible to obtain a better overview of trafficking flows instead of targeting specific individuals.

The different projects conducted within this research emphasise the need for data triangulation and using various source of information to get a more holistic view of the criminality, in this case illegal drug trafficking.