Percepção da utilização da rede na biblioteca da UA

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Técnicas de Percepção de Redes

Problema

Classificar padrões dos utilizadores da rede da biblioteca da UA:

- Estudo (leitura de artigos)
- Entretenimento (streaming)
- Aulas online
- P2P (ilícito)

Bloquear conteúdo ilícito após a sua deteção:

- P2P

Detectar anomalias(bots):

- Intervalos periódicos entre pedidos

Data Sources

Uso de máquinas virtuais para simular os pedidos à rede.

Captura de pacotes no dispositivo pessoal conectado à rede da UA.

Used datasets and metrics to extract from raw data

Pacotes capturados com Wireshark durante cerca de 70 minutos.

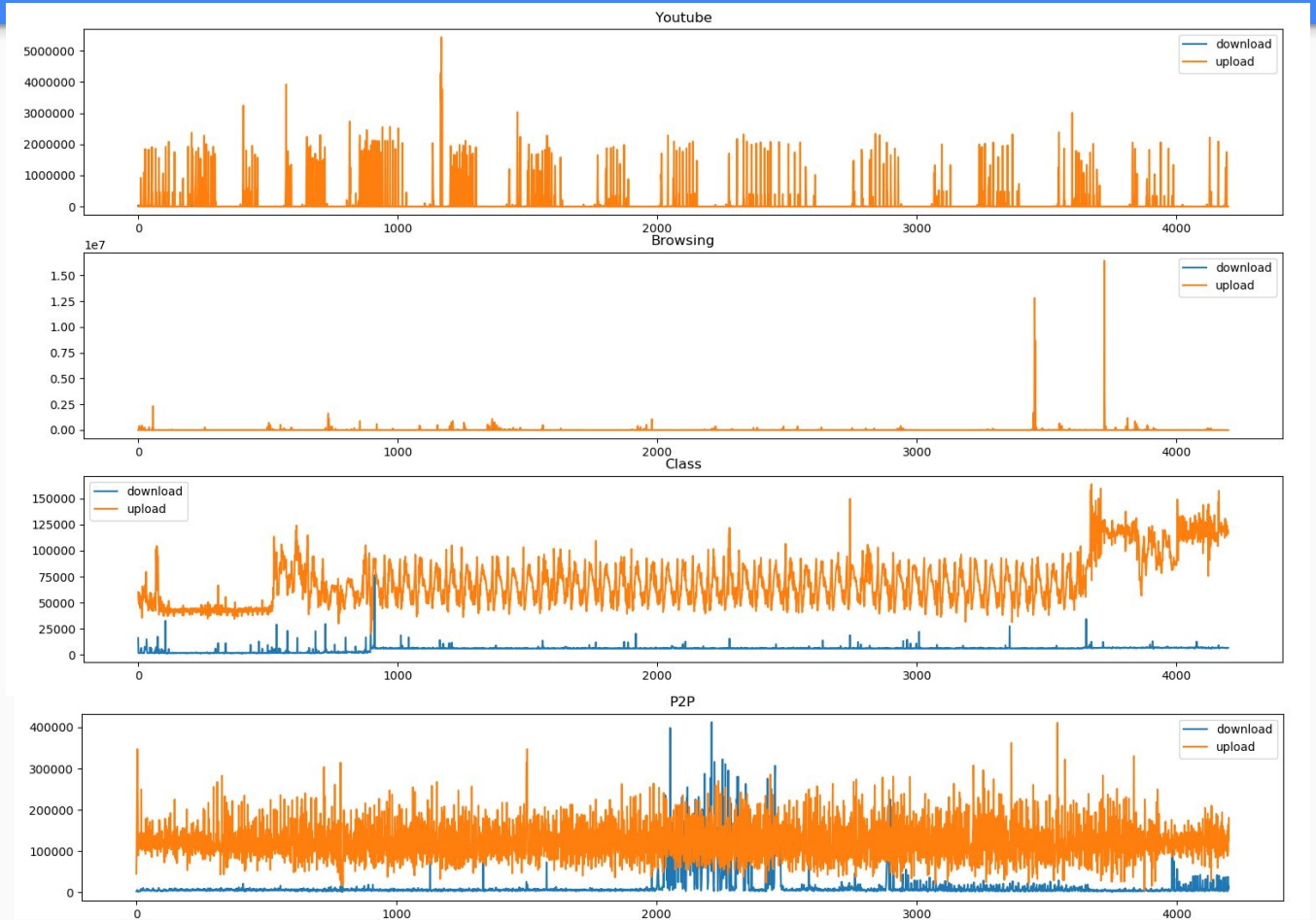
Pacotes de diferentes atividades:

- Browsing (notícias e artigos)
- Youtube com reprodução automática
- Vídeo chamada no Microsoft Teams
- µTorrent com download/upload limitado a 112 kb
- Comportamento de 3 diferentes bots (para a deteção de anomalias)

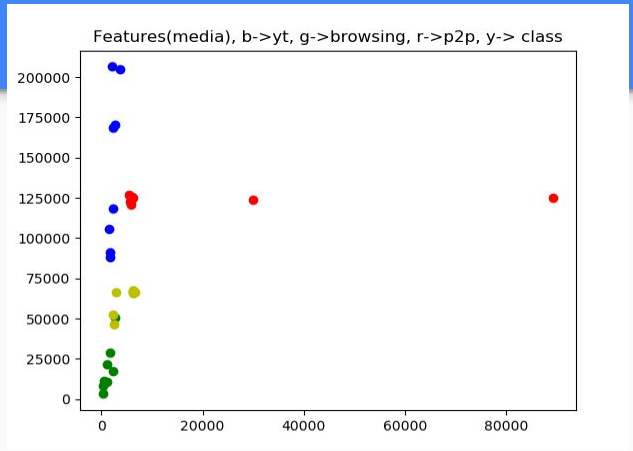
Processamento dos pacotes extraídos para a obtenção do número de downloaded bytes/uploaded bytes em cada segundo.

Armazenamento num ficheiro de texto.

Packets metrics



Deteção de Anomalias



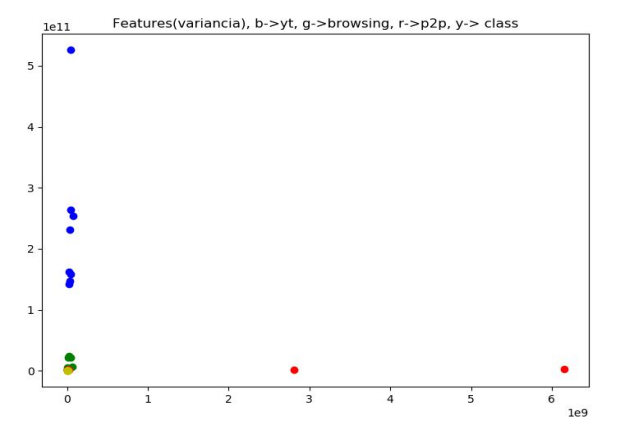
Features utilizadas:

- Variância
- Média
- Média e desvio padrão do silêncio (threshold 256 bytes)
- Wavelets

Modelos de Machine Learning:

- One Class Support Vector Machines (permite detectar o outsider num conjunto de dados)
  - com e sem PCA features
  - função linear, rbf (radial basis function) e polinomial

Samples de 5 minutos
Percentagem treino - 60%
Percentagem teste - 40%



Resultados

One Class Support Vector Machines (PCA Features):

- Kernel Linear - 63%
- Kernel RBF- 70%
- Kernel Poly- 60%

One Class Support Vector Machines (Feature Normalization):

- Kernel Linear - 57%
- Kernel RBF- 47%
- Kernel Poly- 53%

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-- Anomaly Detection based on One Class Support Vector Machines (PCA Features) --
Obs:  0 (YouTube ): Kernel Linear->Anomaly    | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs:  1 (YouTube ): Kernel Linear->OK         | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs:  2 (YouTube ): Kernel Linear->Anomaly    | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs:  3 (YouTube ): Kernel Linear->Anomaly    | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs:  4 (YouTube ): Kernel Linear->Anomaly    | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs:  5 (YouTube ): Kernel Linear->Anomaly    | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs:  6 (YouTube ): Kernel Linear->Anomaly    | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs:  7 (Browsing): Kernel Linear->Anomaly    | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs:  8 (Browsing): Kernel Linear->OK         | Kernel RBF->Anomaly    | Kernel Poly->OK
Obs:  9 (Browsing): Kernel Linear->OK         | Kernel RBF->Anomaly    | Kernel Poly->OK
Obs: 10 (Browsing): Kernel Linear->Anomaly    | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs: 11 (Browsing): Kernel Linear->Anomaly    | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs: 12 (Browsing): Kernel Linear->Anomaly    | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs: 13 (Browsing): Kernel Linear->Anomaly    | Kernel RBF->Anomaly    | Kernel Poly->OK
Obs: 14 (P2P     ): Kernel Linear->OK         | Kernel RBF->OK         | Kernel Poly->OK
Obs: 15 (P2P     ): Kernel Linear->OK         | Kernel RBF->Anomaly    | Kernel Poly->OK
Obs: 16 (P2P     ): Kernel Linear->OK         | Kernel RBF->Anomaly    | Kernel Poly->OK
Obs: 17 (P2P     ): Kernel Linear->OK         | Kernel RBF->Anomaly    | Kernel Poly->OK
Obs: 18 (P2P     ): Kernel Linear->OK         | Kernel RBF->OK         | Kernel Poly->OK
Obs: 19 (P2P     ): Kernel Linear->OK         | Kernel RBF->Anomaly    | Kernel Poly->OK
Obs: 20 (P2P     ): Kernel Linear->OK         | Kernel RBF->OK         | Kernel Poly->OK
Obs: 21 (VideoCall): Kernel Linear->Anomaly   | Kernel RBF->OK         | Kernel Poly->OK
Obs: 22 (VideoCall): Kernel Linear->OK        | Kernel RBF->Anomaly    | Kernel Poly->OK
Obs: 23 (VideoCall): Kernel Linear->Anomaly   | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs: 24 (VideoCall): Kernel Linear->Anomaly   | Kernel RBF->Anomaly    | Kernel Poly->OK
Obs: 25 (VideoCall): Kernel Linear->Anomaly   | Kernel RBF->OK         | Kernel Poly->OK
Obs: 26 (VideoCall): Kernel Linear->Anomaly   | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs: 27 (VideoCall): Kernel Linear->Anomaly   | Kernel RBF->OK         | Kernel Poly->Anomaly
Obs: 28 (Bot     ): Kernel Linear->OK         | Kernel RBF->Anomaly    | Kernel Poly->Anomaly
Obs: 29 (Bot     ): Kernel Linear->OK         | Kernel RBF->Anomaly    | Kernel Poly->Anomaly
Obs: 30 (Bot     ): Kernel Linear->OK         | Kernel RBF->Anomaly    | Kernel Poly->Anomaly
Obs: 31 (Bot     ): Kernel Linear->OK         | Kernel RBF->Anomaly    | Kernel Poly->Anomaly
Obs: 32 (Bot     ): Kernel Linear->OK         | Kernel RBF->Anomaly    | Kernel Poly->Anomaly
Obs: 33 (Bot     ): Kernel Linear->OK         | Kernel RBF->Anomaly    | Kernel Poly->Anomaly
Obs: 34 (Bot     ): Kernel Linear->OK         | Kernel RBF->Anomaly    | Kernel Poly->Anomaly
```

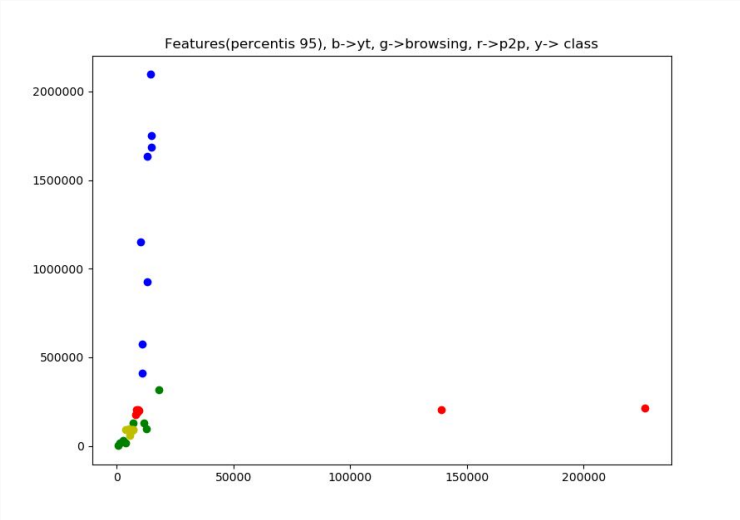
Classificação

Features utilizadas:

- Percentis
- Média e desvio padrão do silêncio (threshold 256 bytes)
- Wavelets

Modelos de Machine Learning:

- Support Vector Machines (permite classificar conjuntos de dados de acordo com os valores das features)
  - com e sem PCA features
  - função linear, rbf e poli kernel
- Neural networks
  - com e sem PCA features



Resultados

Support Vector Machines (Feature Normalization):

- Kernel Linear - 96%
- Kernel RBF- 87%
- Kernel Poly- 92%

Support Vector Machines (PCA Features):

- Kernel Linear - 88%
- Kernel RBF- 83%
- Kernel Poly- 79%

Neural Networks (PCA Features):

- 92%

Neural Networks (Feature Normalization):

- 83%

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-- Classification based on Support Vector Machines --
Obs:  0 (YouTube ): Kernel Linear->YouTube     | Kernel RBF->Browsing   | Kernel Poly->YouTube
Obs:  1 (YouTube ): Kernel Linear->YouTube     | Kernel RBF->Browsing   | Kernel Poly->YouTube
Obs:  2 (YouTube ): Kernel Linear->YouTube     | Kernel RBF->YouTube    | Kernel Poly->YouTube
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Obs:  8 (Browsing): Kernel Linear->Browsing    | Kernel RBF->Browsing   | Kernel Poly->YouTube
Obs:  9 (Browsing): Kernel Linear->Browsing    | Kernel RBF->Browsing   | Kernel Poly->Browsing
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Obs: 23 (VideoCall): Kernel Linear->VideoCall  | Kernel RBF->VideoCall  | Kernel Poly->VideoCall
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Obrigado pela vossa atenção