if (copy\_to\_user(arg, sizeof(\*s\_cmd) + u\_cmd.insize))

if (ret < 0)

Added Statements During Fixing

line 22

line 13

s\_cmd->command += ec->cmd\_offset;

line 23

if (u\_cmd.outsize != s\_cmd->outsize || u\_cmd.insize != s\_cmd->insize)

line 14

line 27

if (copy\_from\_user(s\_cmd, arg, sizeof(\*s\_cmd) + u\_cmd.outsize))

line 15

line 26

s\_cmd = kmalloc(sizeof(\*s\_cmd) + max(u\_cmd.outsize, u\_cmd.insize), GFP\_KERNEL);

if ((u\_cmd.outsize > EC\_MAX\_MSG\_BYTES) || (u\_cmd.insize > EC\_MAX\_MSG\_BYTES))

line 25

if (copy\_from\_user(&u\_cmd, arg, sizeof(u\_cmd)))

struct cros\_ec\_command u\_cmd;

struct cros\_ec\_command u\_cmd;

if (copy\_from\_user(s\_cmd, arg, sizeof(\*s\_cmd) + u\_cmd.outsize))

Ret = =EFAULT;

goto exit;

copy to user arg cmd size of cmd in size

**arg** if (copy\_ …

**u\_cmd.insize** struct …

Sub-tree based Summarization Model

GRU

GRU

**Fline-27,1**

**Fline-27,2**

**Fline-27,3**

**Fline-27,k+2**

LSTM

LSTM

LSTM

LSTM

Attention Layer

GCN Model

Weights

Weighted Node Feature Representation Vectors from Line 22,25,26,29

⊕

⊕

……

……

**Node Feature Representation Vectors**

……

**Sub-tokens**

**Variable arg**

**Variable u\_cmd.insize**

**Sub-tree**

Sub-tokens

Sub-AST

……

……

……

……

……

**…**

**…**

copy to user

arg

cmd

size of

cmd

in size

FS-27,1

F’S-27,1

FS-27,2

F’S-27,2

FS-27,3

F’S-27,3

FS-27

Feature Representation Vector for S-27

F’i,j (i = S-22, S-25, S-26, S-29; j = 1,…,k+2)

FS-27,k+2

F’S-27,k+2

LSTM

LSTM

LSTM

LSTM

Attention Layer

Tree Representation Model (ASTNN)

GRU

GRU

GloVe

GloVe

s\_cmd S-10 S-13 S-22 S-23

s\_cmd

S-10

S-13

S-22

S-23

None

ec->ec\_dev

None

S-27: if (copy\_to\_user(arg, s\_cmd, sizeof(\*s\_cmd) + u\_cmd.insize))

Method

Variable Name

Slicing

Variable Name

Slicing

⊕

⊕

Weights

Statement Representation Vector for S27

Spatial Pyramid Pooling

Feature Matrix for S27

……

Feature Representation Generation

Classifier

……

⊕

S27

S29

S26

S25

S22

Program Dependency Graph

……

Statement Representation Matrix for S27

Method

Fully Connected Layer

Normalized Symmetric Adjacency Matrix for S27

Detection Result for M

……

Merging Layer

Join Layer

Join Layer

Fully Connected Layer

Spatial Pyramid Pooling

Stmt Rep Vector for S27

Stmt Rep Vector for S23

Convolution

A

……

……

Feature Matrix for S27

Feature Representation Generation

……

……

……

……

S27

S29

S26

S25

S22

S31

S23

S6

A

Classifier

Detection Result for M

Stmt Rep Matrix for S27

Symmetric normalized Laplacian Matrix for S27

B

……

B

……

Convolute

……

Convolution

Stmt Rep Matrix for S23

Feature Vector for S27

Join Layer

Fully Connected Layer

Spatial Pyramid Pooling

Detection Result for M

Classifier

Convolution

Feature Matrix

Feature Representation Generation

S27

S29

S26

S25

S22

S31

S23

S6

Convolute

A

B

A

……

……

……

……

……

(Fig 4)

B

Method Rep Matrix

Feature Representation Generation

Symmetric normalized Laplacian Matrix

Feature Vector for S23

……

Program Dependency Graph

S27

S29

S26

S25

S22

S31

S23

S6

Edge

S27

S29

S26

S25

S22

S31

S23

S6

No Inclusion

Vulnerable

Detection

Model

Inclusion

Non Vulnerable

Edge Mask

Feature

No Inclusion

Vulnerable

Detection Model

Inclusion

Non Vulnerable

Feature Mask

E[CLS]

E1

E[SEP]

E1’

EM’

H[CLS]

H1

H[SEP]

H1’

HM’

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if

[SEP]

concur-rent

program

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SoftMax

Classification Score

BERT

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CWE-362

S27

Code

Relevant Statements

Variable and Slicing

Relevant CWE

Detection Result

Non-vulnerable

Vulnerability Detection Model

Interpretable Model

Text Message Retrieval Model

Vulnerable

Vulnerable

Explanation

Method

PDG

Node Features

Graph-based Vulnerability Detection

Vulnerability Detection Results

Graph-based Explanation Generation

Sub-graph

Key Features

Code and Keywords Mapping

Relevant Keywords

Relevant CWE